Engineering Library

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Founded 1874—Fifty-Five Years of Service

Electrical World

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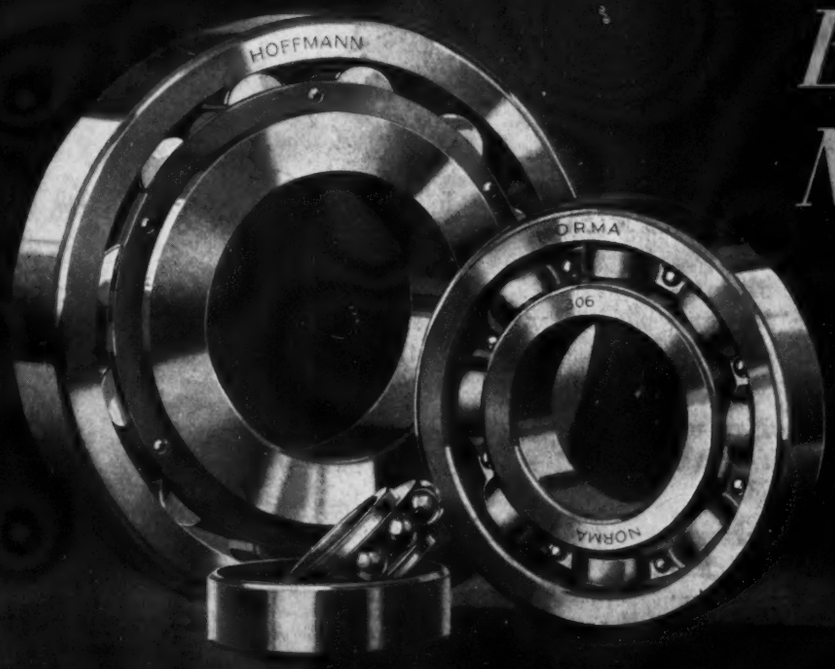
FOR
BETTER MOTORS



Our engineers offer you their cooperation, with a long and highly specialized experience.

May they work with you?

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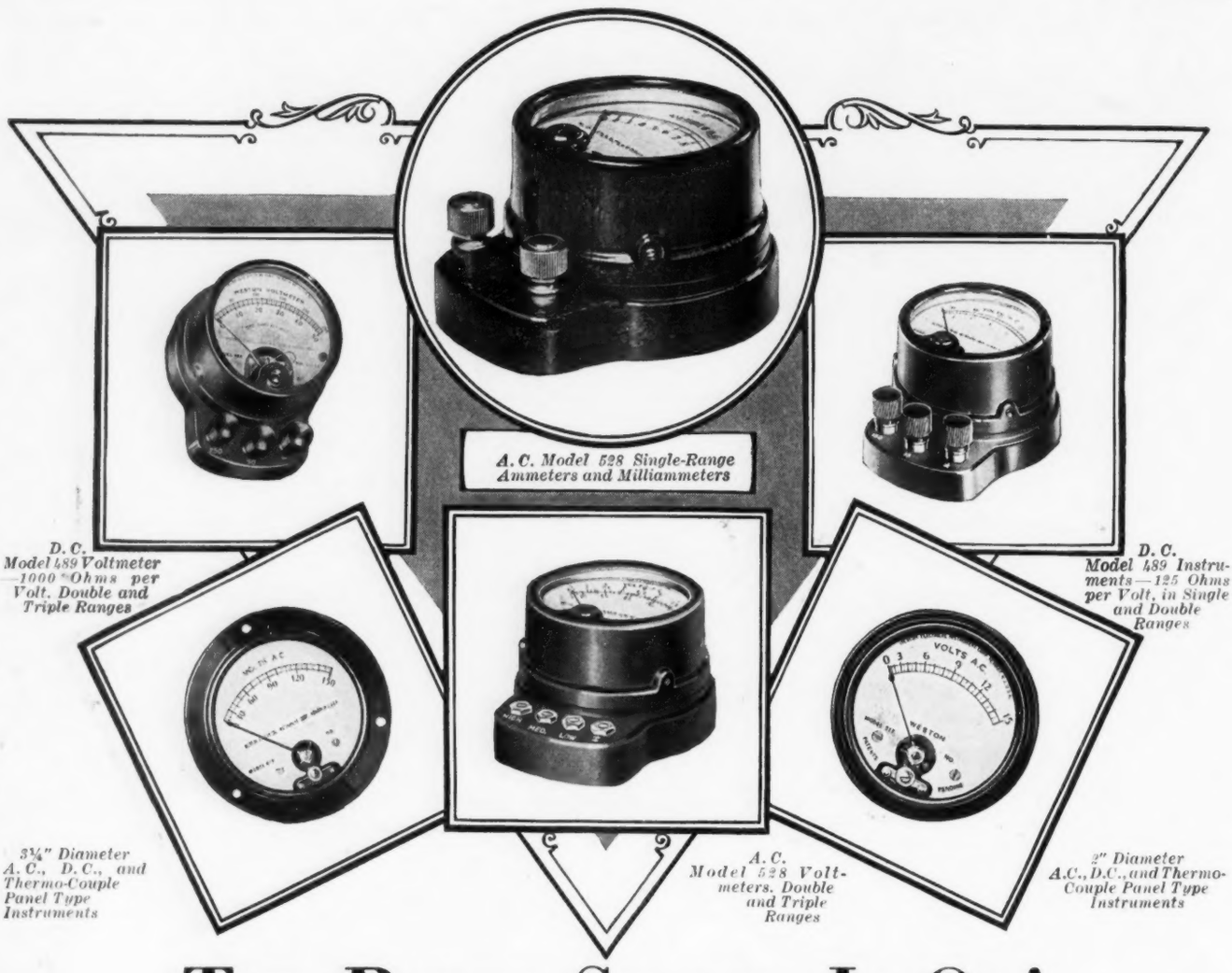
A. C. Model 528 Single-Range Ammeters and Milliammeters
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THE RADIO SEASON IS ON!

AIR HUNTING—that's what millions of devotees of the great, indoor-outdoor fall and winter sport are now thinking about.

Radio sets to be conditioned—circuits gone over and new tubes installed. It's just like oiling up guns and getting a supply of cartridges for that other great annual sport—GAME HUNTING.

In air hunting, electrical measuring instruments are your licenses—you can't operate satisfactorily or safely without them. Moreover, your instruments, like your licenses, must be backed by authority or else they won't do you any good.

Weston Miniatures are the first choice and the last word in radio. From the great broadcasting station to the individual radio receiver Weston stands for all that is best and authoritative in electrical measurement.

Amateur transmitters, radio service men and dealers—manufacturers—research laboratories and technical schools—all whose business or scientific interest is concerned with radio developments know that Weston is synonymous with highest quality and the most dependable service.

Supplied in a variety of models and ranges. Reasonably priced.

Weston
PIONEERS SINCE 1888
INSTRUMENTS

WESTON ELECTRICAL INSTRUMENT CORPORATION
578 Frelinghuysen Avenue **Newark, New Jersey**

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CABLE ADDRESS:
"MACHINIST, N. Y."

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Wires and cables insulated with Okonite varnished cambric, of every type and application, have been used for many years in all parts of electric power plants: generating stations, switching stations, sub-stations, and for underground, submarine, and aerial power cables.

Quality means performance with varnished cambric cables just as much as with other insulation. We, therefore, give the most scrupulous attention to the selection of materials and to every detail in the manufacture of these cables in order that their reliability is assured.

Inquiries are solicited and our engineering service is always available.

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FOUNDED 1878
THE OKONITE-CALLENDER CABLE COMPANY, INC.
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OKONITE QUALITY CANNOT BE WRITTEN INTO A SPECIFICATION

The air gauge tells you that G&W Boxes are Air Tight

G & W Boxes are equipped with a tire valve for air testing

A simple, yet effective means of service protection is furnished with all G & W Boxes. You can be sure that your underground boxes will be air tight as well as water tight.

After a box has been opened it should be air tested upon closing. This acts as a check to determine if cover has been properly fastened. Air up to 5 lbs. is pumped into the box through the tire valve after lid is fastened. If the gauge (5 to 10 lbs. maximum) shows that air pressure is maintained you are assured of no air leakage of box.

Such an air test is invaluable when a box is first installed. It indicates whether the cable heads and the lid have been properly installed.

The correct design and reliability of G & W Boxes has been clearly demonstrated by the great numbers now giving economical and satisfactory service over long periods.

Central Stations are today encouraging semi-annual inspection of all underground equipment. This G & W air-testing feature thus becomes of real value to the industry. It is an indication of this organization's ability to meet modern needs and advance modern ideas.

G & W Electric Specialty Co., 7780 Dante Ave., Chicago

Exactly what you want

G&W

See our Catalog No. 27

More than Protection for the Cable Ends

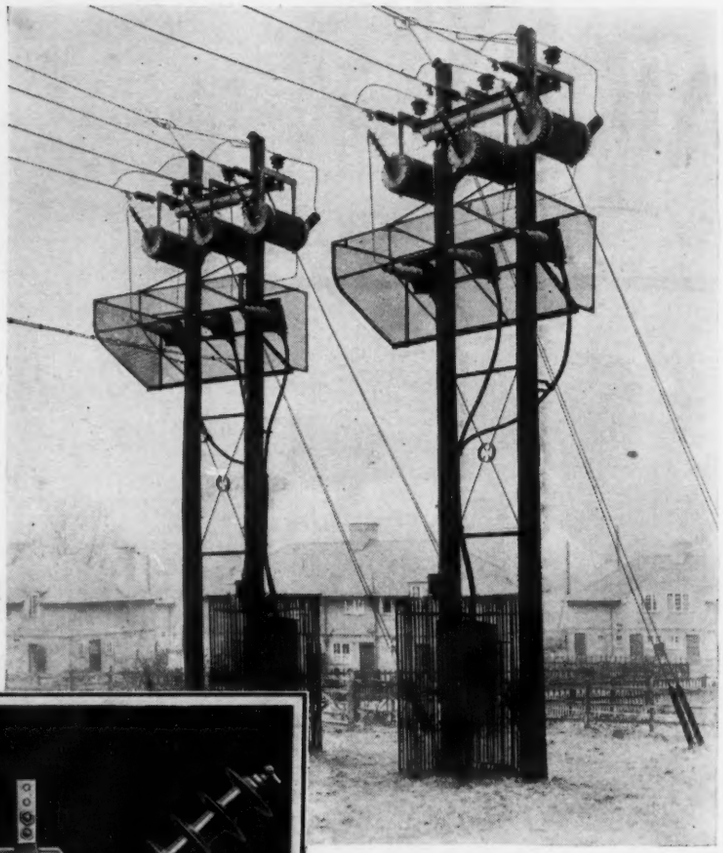
POTHEADS AND BOXES

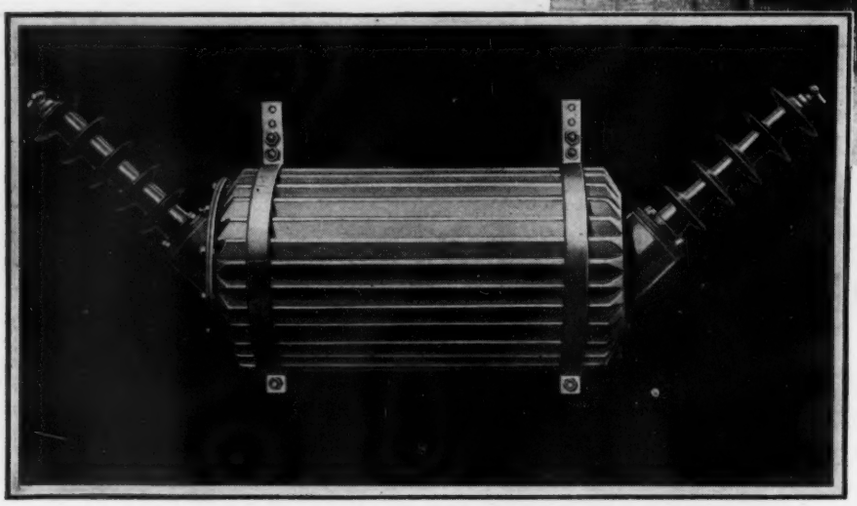
The Effective Surge Absorber

For the protection of inductive apparatus at the terminals of Transmission Lines from surges of steep wave-front.

Connected in series with the line, the Absorber dissipates the energy in the surge without grounding the line.

Its effectiveness has been determined by actual test under conditions which approximate closely to those obtaining in service.





Suitable for connecting in cables and transmission lines of voltages from 220 to 220,000.

FERRANTI
SURGE ABSORBER

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New York, U. S. A.

Ferranti, Ltd.
Hollinwood
Lancashire, England

Ferranti Electric Limited
26 Noble Street
Toronto, Canada

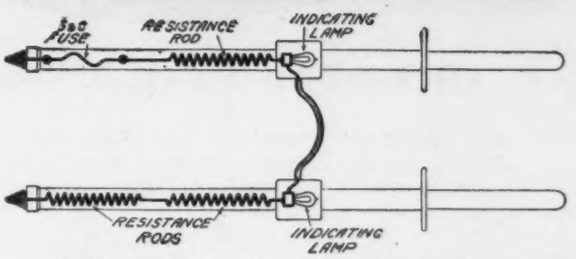
He Knows His Circuits

TO paraphrase a common expression, this man "knows his circuits." He knows which are alive and which are dead, which are open and which are closed, because he makes tests with

The S&C High Voltage Detector

He will cheerfully test before the next operation because it is so very easy to use this light weight, easy-to-handle testing device that gives a positive indication of the presence of potential. That is why it is an aid to the enforcement of safety first regulations.

He uses the Type BT Detector shown here on potential tests, phasing out, etc., on circuits up to 15,000 volts, indoors. An S&C Detector, Type AT, is also used for outdoor tests up to 6,600 volts.



Wiring Diagram Type BT Voltage Detector

THE S&C Type BT High Voltage Detector consists of a simple combination of a high resistance and a pair of indicating lamps in series with an S&C Fuse. These elements are contained in Bakelite tubes equipped with handles. The high resistance limits the current to a correct value for lighting the small indicating lamps and the detector is connected directly across the line. The proper resistance is supplied for the particular voltage on which the detector is to be used.

Bulletin 214 gives complete information on various types of S&C High Voltage Detectors and a copy will be gladly supplied on request.

Makers of the S&C *High Potential Fuse*

SCHWEITZER S&C CONRAD, INC.

4435 RAVENSWOOD AVENUE CHICAGO, ILLINOIS U.S.A.

Boston, New York, Philadelphia, Buffalo, Pittsburgh, Cleveland, Duluth, Detroit, Birmingham

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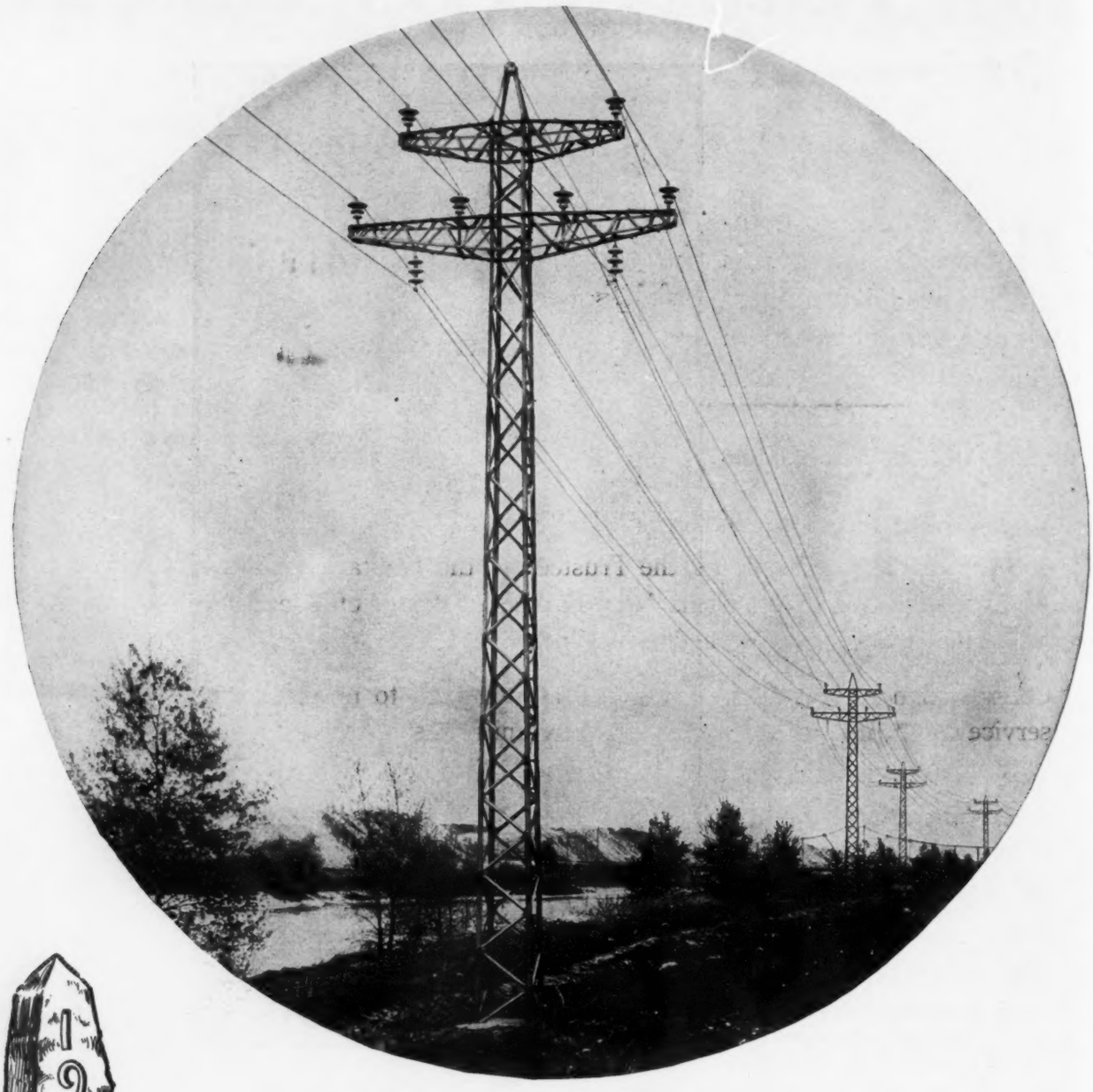
THE TWENTY-YEAR STORY O



1911---The Third Milestone

The 44,000-volt transmission line of the Sanitary District of Chicago, running along the Drainage Canal from Chicago to Lockport. The O-B suspension insulators were installed in 1911.

This is the third of a series of advertisements telling the 20-year story of O-B insulator development.

OF INSULATOR DEVELOPMENT

Milestones of Transmission Line Construction

TRANSMISSION facilities of the Sanitary District of Chicago, in 1911, were not sufficient to take care of the growing load placed on its lines by the extension of Chicago's boulevard lighting system, and by the other growing power requirements served.

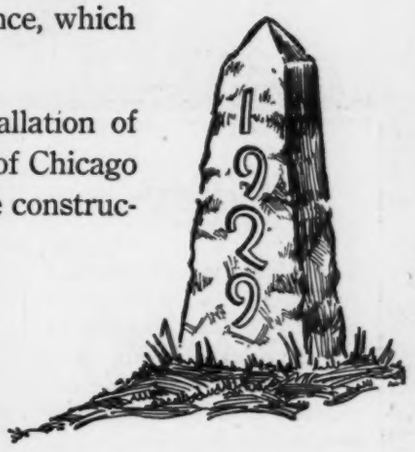
So additional transmission facilities were planned to carry power from the Lockport power house, 30 miles below Chicago, to the substation at Western Avenue and the Drainage Canal.

Recognizing the successful experience of others in the use of O-B cap and pin suspension insulators, the Trustees of the Sanitary District investigated and selected O-B insulators for use in strings of three 10-inch units to insulate their new 44,000-volt line.

Certain changes in design were made at this time to provide for new service conditions. The spacing between units was reduced, thus permitting more insulation to be packed into a given string length. This important fundamental change was responsible for the design of O-B Insulator No. 25622, of which millions are now in service.

More of these short spaced units can be put in a string of given length, thereby providing more effective insulation. Among other things, efficient use of string length makes better use of tower clearance, which is an item on a transmission line.

Thus, because it marks this important design change, the installation of O-B suspension insulators on the lines of the Sanitary District of Chicago added another milestone in the progress of transmission line construction and insulation.

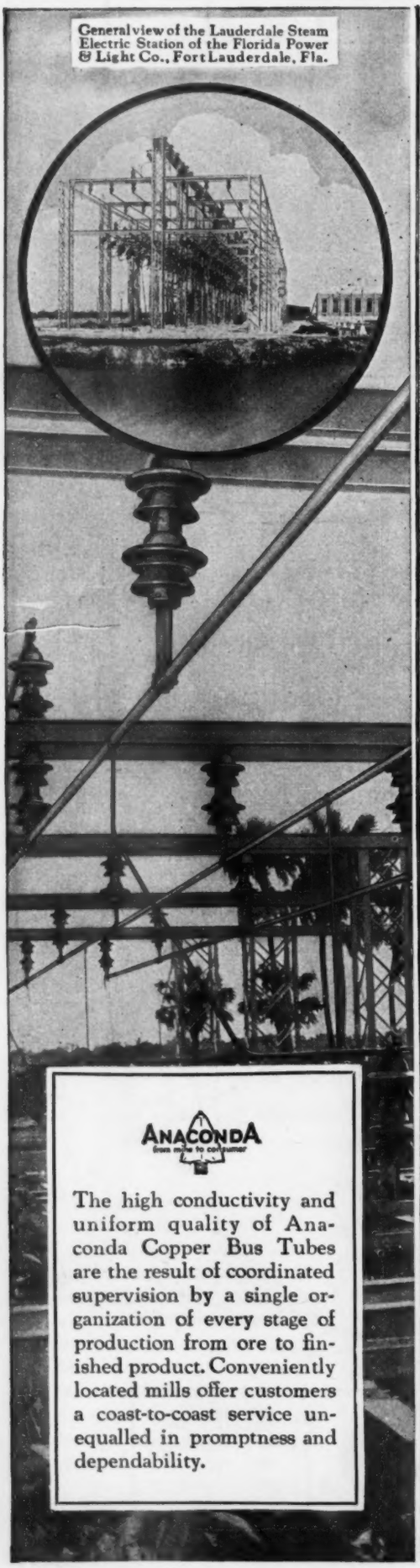


Ohio Brass Company, Mansfield, Ohio
Canadian Ohio Brass Co., Limited
Niagara Falls, Canada
1119H

Ohio Brass Co.

NEW YORK PITTSBURGH PHILADELPHIA BOSTON CHICAGO CLEVELAND ST. LOUIS ATLANTA SAN FRANCISCO LOS ANGELES DALLAS

PORCELAIN INSULATORS
LINE MATERIALS
RAIL BONDS
CAR EQUIPMENT
MINING MATERIALS
VALVES


General view of the Lauderdale Steam Electric Station of the Florida Power & Light Co., Fort Lauderdale, Fla.
ANACONDA
The high conductivity and uniform quality of Anaconda Copper Bus Tubes are the result of coordinated supervision by a single organization of every stage of production from ore to finished product. Conveniently located mills offer customers a coast-to-coast service unequalled in promptness and dependability.

COPPER BUS TUBES

to your specifications

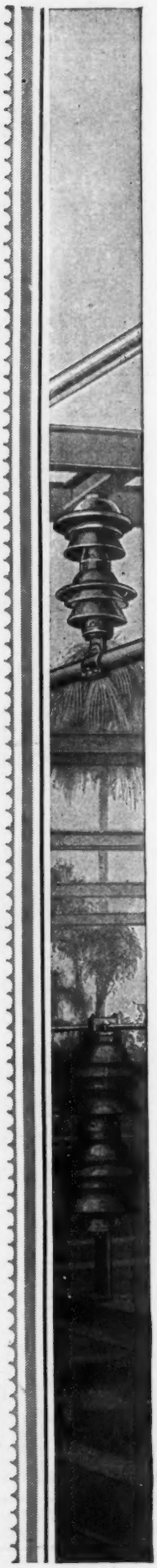
ANACONDA Bus Tubes are manufactured from copper guaranteed 99.9% pure by processes developed during more than a century of experience in the manufacture of copper and copper alloys. They can be supplied with a minimum conductivity of 98% when hard drawn. Hard drawn copper tubes have greater rigidity and higher tensile strength than soft drawn tubes, thus raising the yield point. Up to the yield point, however, sag is independent of tensile strength.

In case it is desired to make short radius bends or to flatten the ends for making connections, soft or medium temper should be specified, depending on requirements.

Whatever your bus tube requirements may be, Anaconda can meet them with a tubular conductor of superior quality designed to carry the specified load with maximum efficiency. The facilities of our Technical Department are at your service.

THE AMERICAN BRASS COMPANY
General Offices: Waterbury, Connecticut
Offices and Agencies in all Principal Cities
Canadian Mill: ANACONDA AMERICAN BRASS LTD.
New Toronto, Ontario

ANACONDA
COPPER ANACONDA BRASS



A New Anchor

the greatest ever made

THE NEW PREHEATED CERTIFIED MALLEABLE

MATTHEWS
SCRULIX ANCHORS

PATENTS APPLIED FOR

50% GREATER HOLDING POWER

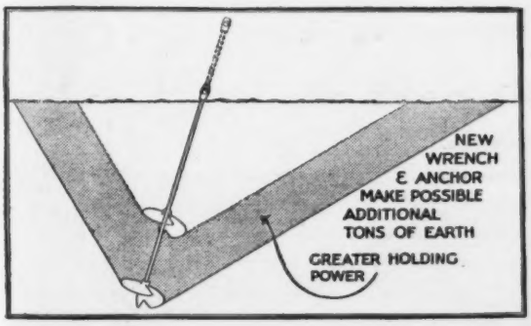
GUARANTEED!

Installing ordinary screw anchor

Men work in uncomfortable strained position. Wrench handle catches on ground while anchor rod is still two feet out of ground. —yet anchor is down as far as old wrench can put it unless men dig ground away or use a ratchet handle. It has always been difficult if not impossible to get them to do this.

Installing the New Matthews Scrulix Anchor with the New Matthews Wrench

The new Matthews Wrench permits men to stand in upright comfortable position during entire installation— end of rod is down to ground level. New Matthews Scrulix Anchor is down two feet deeper than ordinary anchor— the result is at least 50% greater holding power—actual tests have shown double holding power of the ordinary screw anchor of the same size, installed by same men in the same ground.



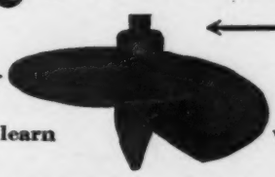
Dotted line shows usual depth of ordinary screw type anchor — Black line shows depth of new Matthews Scrulix Anchor.

Two feet deeper intallation gives new Matthews Scrulix Anchor at least 50% greater holding power.

EASIER and QUICKER to INSTALL

Thinner Shank ←

Thinner Blades →



Test these new anchors and learn what amazing results they give.

W. N. MATTHEWS CORPORATION

Engineers and Manufacturers

3702 Forest Park Blvd., St. Louis, Mo., U. S. A.

Offices in all principal cities

And why should you see Weyerhaeuser? Because Weyerhaeuser—the world's largest lumber producing organization—is making the furnishing of cedar poles one of its *major services* to industry. Because Weyerhaeuser is putting into this effort all its hard won knowledge of timber—all its experience—all its understanding of the requirements of the pole buyer, both as to quality and service.

QUALITY	HANDLING
Immense forests of fine straight Idaho Red Cedar Pole Timber.	Five modern storage yards. Large and complete stocks.
Only experienced pole men employed.	Immediate shipments—practically any quantity of any size.
Only "live" trees used.	Prompt advice on car numbers, routing and probable arrival date.
Expert seasoning.	
Frequent and rigid inspection.	Prompt tracing and advices.
Expert storing and loading to avoid damage.	Responsible transaction throughout.

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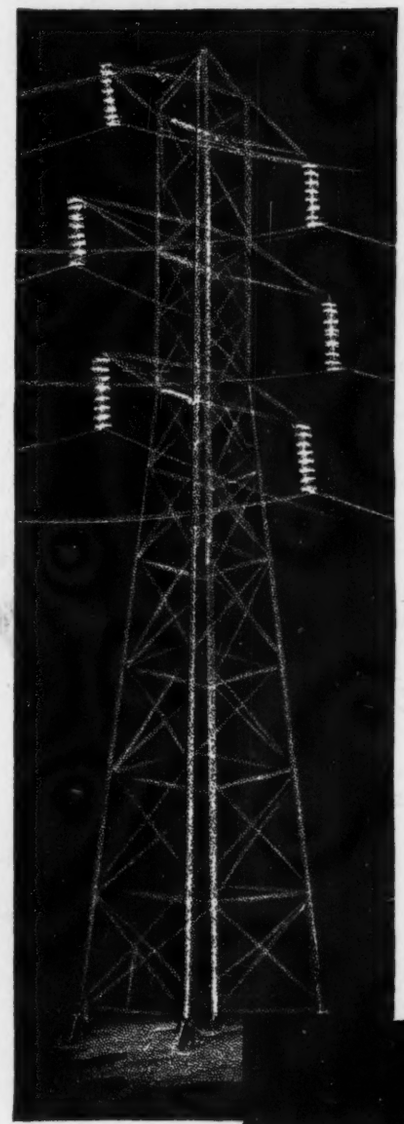
R. L. Bayne, Spokane Office, Manager of Cedar Pole Service

WEYERHAEUSER Idaho Red Cedar Poles

A Uniformity Obtainable Through No Other Process!



HOMER in his myths mentions the art of forging swords. Much praise is given to the swordsmith in the tales of King Arthur and his round table. For these ancients discovered that heating and hammering the metal produced a pliant, fine textured weapon of uniformity, capable of retaining its keen edge over a long period of time.

To-day modern industry places that same faith in the drop forging. Passing down from generation to generation it has improved until to-day it is a prime factor where uniformity of metal is required.

And this same solid argument cannot be shaken when applied to the caps for high tension suspension type insulators. Trial and error is a sure way of discovering weak caps but it is a costly old-fashioned method. The better and cheaper way in the long run is to specify BTC Drop Forged Caps. There is no need for further testing for they are 100% uniform in quality—proven over years of testing.

Why a Drop Forged Cap?

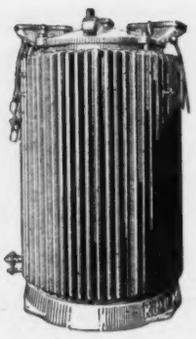
1. They are 100% uniform in quality.
2. They are made of Copper-Bearing Steel to resist corrosion.
3. Their superior strength has been proven by many tests.
4. They can be heat treated to a maximum strength with minimum weight.
5. They are free from hidden defects or concealed flaws.

Write for our booklets explaining the process of drop forging and research into corrosion of iron and steel

Engineers are Considering These Facts in Specifications for Power Line Contracts

The
Brewer-Titchener Corp.
Cortland, N. Y.

He Isn't "*Poeting*" About Transformers



WHEN a genuine, long-haired, aged in the wood, three-phase poet cranks up his lyre and takes a spin around Parnassus, he never "poets" about transformers.

He'd blow his circuit breakers clear back to the coal pile if he tried it.

Because transformers are just naturally unromantic and unlyrical — the muses never heard of them.

It seems a shame, too, because transformers as good as Kuhlman makes them deserve poetic praise.

Good because we stop at nothing to make them better.

KUHLMAN ELECTRIC CO., Bay City, Mich.

KUHLMAN TRANSFORMERS

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High and Barges Sts.

Atlanta, Georgia
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1431 Healy Bldg.

Baltimore, Md.
Industrial Power Equip. Co.
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Continental Sales & Eng. Co.
839 Oliver Bldg.

Rochester, N. Y.
Geo. W. Foote
601 Temple Bldg.

San Francisco, Cal.
C. F. Henderson
Call Building

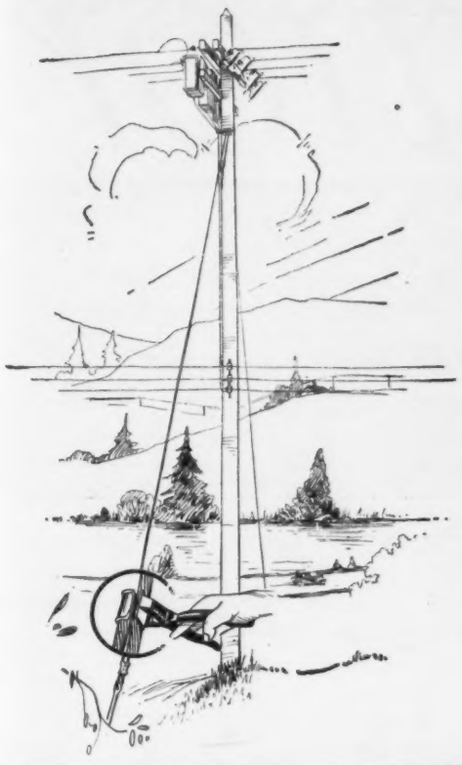
Seattle, Wash.
Equipment Sales Co.
514 Lloyd Bldg.

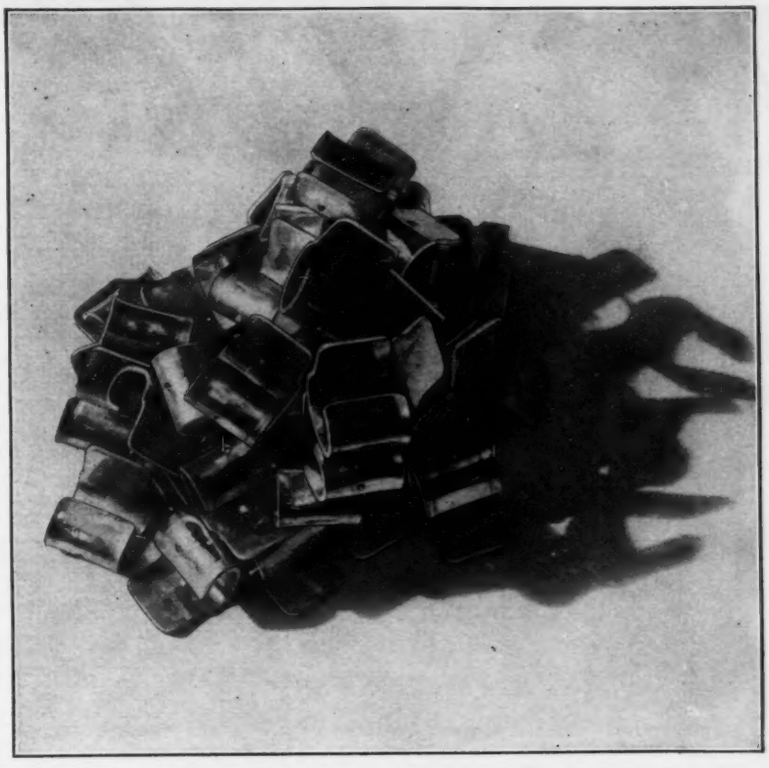
Tampa, Fla.
Tampa Hardware Co.
Polk & Morgan Sts.

Toledo, Ohio
Howard J. Wittman
319 Spitzer Bldg.

York, Pa.
Harry W. Motter
25 N. Duke St.

PROTECT STRAND ENDS - -





Actual Service

Kearney Guy Wire Clips, used by hundreds of utilities, are applied with an ordinary pair of pliers or wire twisters. They make all strand ends uniform.

Kearney Products

Certified Malleable Iron Screw Type and Hi-Tension 4-in-1 Expansion Anchors; Solderless Service Connectors; Double Duty Fuse and Disconnect Cutouts; 7500, 12000 and 15000 volt Fuse, Disconnect and Choke Coil Combination Switching Equipment; Fuse Pullers; Expulsion Porcelain Plug Cutouts; Sleeve Twisters with Interchangeable Dies; Economy Cable Clamps; Hot-Tap Clamps; Yokes; Underground Boxes; Live Line Tools and Accessories.

Guy Wire Clips Eliminate "Serving Up" Strand Ends

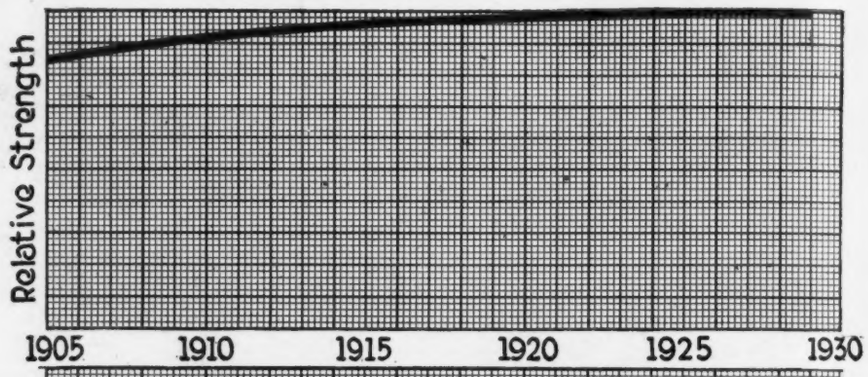
PROTECT strand ends by the use of Kearney Guy Wire Clips. These units clamp in place with ease with an ordinary pair of pliers or wire twisters. The use of Kearney Guy Wire Clips makes all strand ends uniform, saves the galvanizing on the strand, and eliminates the dangerous method of serving strand ends. The clip covers the rough strand ends, holds the strand together, and keeps the strand from untwisting. Kearney Guy Wire Clips are made in three sizes—one size to take 1/4″ and 5/16″ strand, one to take 3/8″ and 7/16″ strand, and another to take 1/2″ and 9/16″ strand. Made of three materials—aluminum, copper, and galvanized iron. Write today for your copy of Bulletin 320.

JAMES R. KEARNEY CORPORATION
4224-40 CLAYTON AVE. ST. LOUIS, MO.
FACTORIES: St. Louis, Kansas City, Mo., Taylorville, Illinois

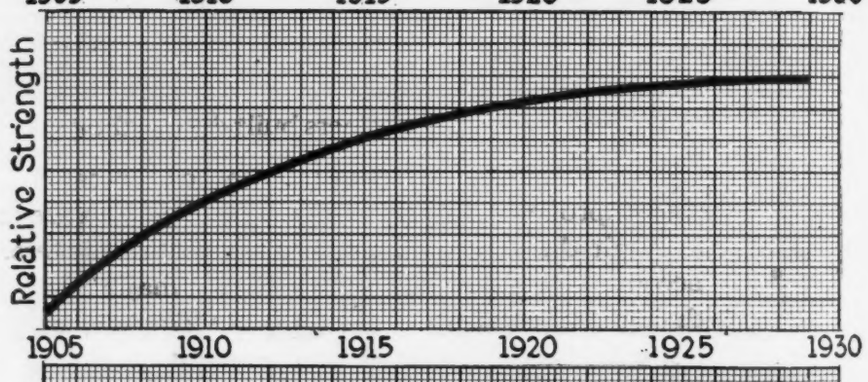
A KEARNEY PRODUCT
BEING ADOPTED NATIONALLY AS STANDARD EQUIPMENT

Insulation

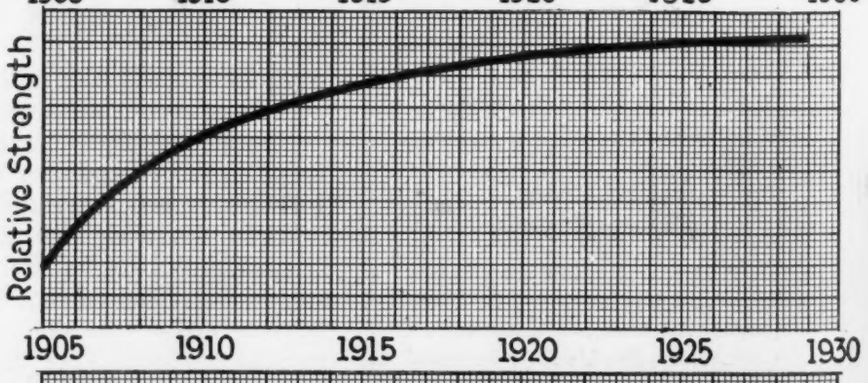
Dielectric strength—insulation between windings



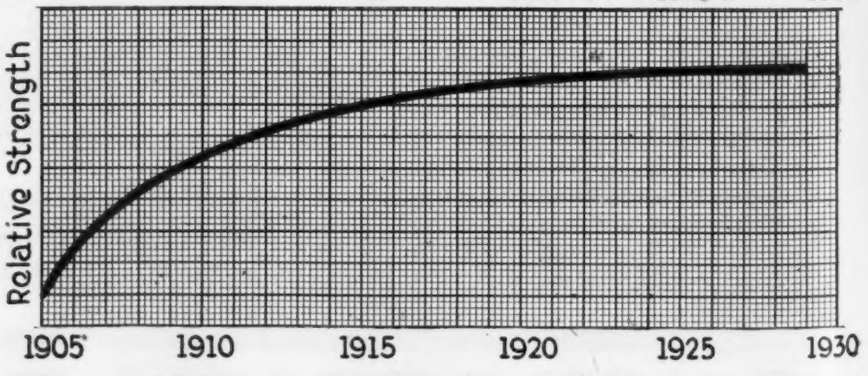
Mechanical strength—insulation between windings



Dielectric strength—conductor insulation



Mechanical strength—conductor insulation



GENERAL

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

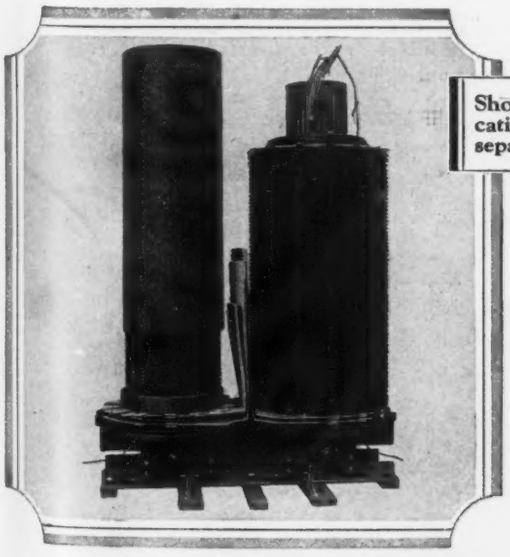
for G-E transformers has constantly improved

THE life of a transformer is in its insulation. Any improvement in quality of insulation is sure to be reflected in longer trouble-free service given by the transformer.

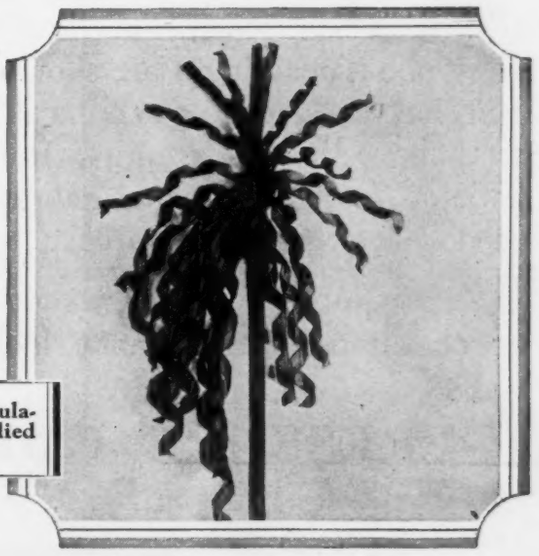
As evidence of G-E transformer reliability, one large operating company reported, for the year 1928, that its ratio of burnouts to installed G-E transformers on its distribution system (based on kv-a.) was .0029. This covered units burned out from lightning, overload, high voltage, and all other causes.

Insulation failures in 1928, among all the G-E power transformers built during the ten years previous to 1928, were less than half those recorded in 1915, covering transformers built during the ten years previous to 1915.

Better insulating materials, more scientifically applied, account for this improvement in service records. The increase in insulation strength per unit thickness, accomplished by G-E engineers, is expressed by the accompanying curves. Herkolite for major insulation was first introduced in 1911; cable paper for conductor insulation in 1915. While these G-E developments were revolutionary, continued research has produced still further improvements.



Showing the application of Herkolite to separate the windings



Cable-paper insulation liberally applied to conductor

JOIN US IN THE GENERAL ELECTRIC HOUR, BROADCAST EVERY SATURDAY AT 8 P.M., E.S.T. ON A NATION-WIDE N.B.C. NETWORK

410-19

GENERAL ELECTRIC

SALES OFFICES IN PRINCIPAL CITIES

SIGNS OF THE TIMES

THE booking season for Hi-Pressure Contact Switches is always on. They are instantly available. You are always assured of satisfactory performance in all seasons. The four big ice-breaking, corrosion-resisting numbers (every one a headliner) are shown at the right. Each has self-cleaning contacts, non-ferrous parts above insulator units, Interchangeable Insulator Units and many refinements which you do not ordinarily appreciate until you see them.

For continuous performance look to

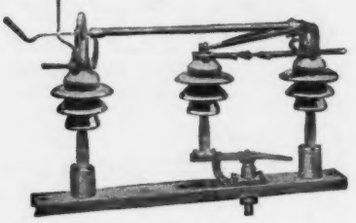
HI-PRESSURE CONTACT SWITCHES

RAILWAY AND INDUSTRIAL
ENGINEERING CO., GREENSBURG, PA.

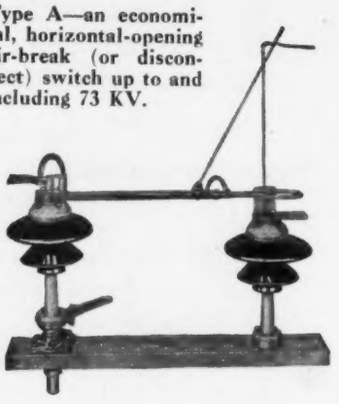
Representatives in

Boston, New York, Philadelphia, Buffalo, Pittsburgh, Cleveland, Chicago, Cincinnati, St. Louis, Denver, Charlotte, Birmingham, Dallas, Indianapolis, Kansas City, Los Angeles, Minneapolis, San Francisco, Seattle, Toronto, Phoenix

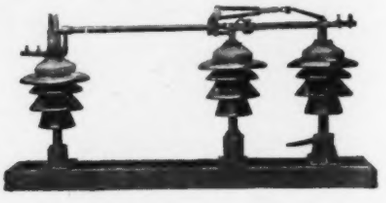
Type TTL—very popular air-break switch for substation or sectionalizing purposes—up to and including 73 KV.



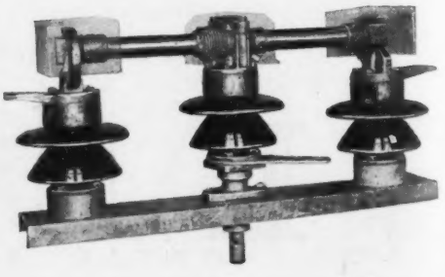
Type A—an economical, horizontal-opening air-break (or disconnect) switch up to and including 73 KV.

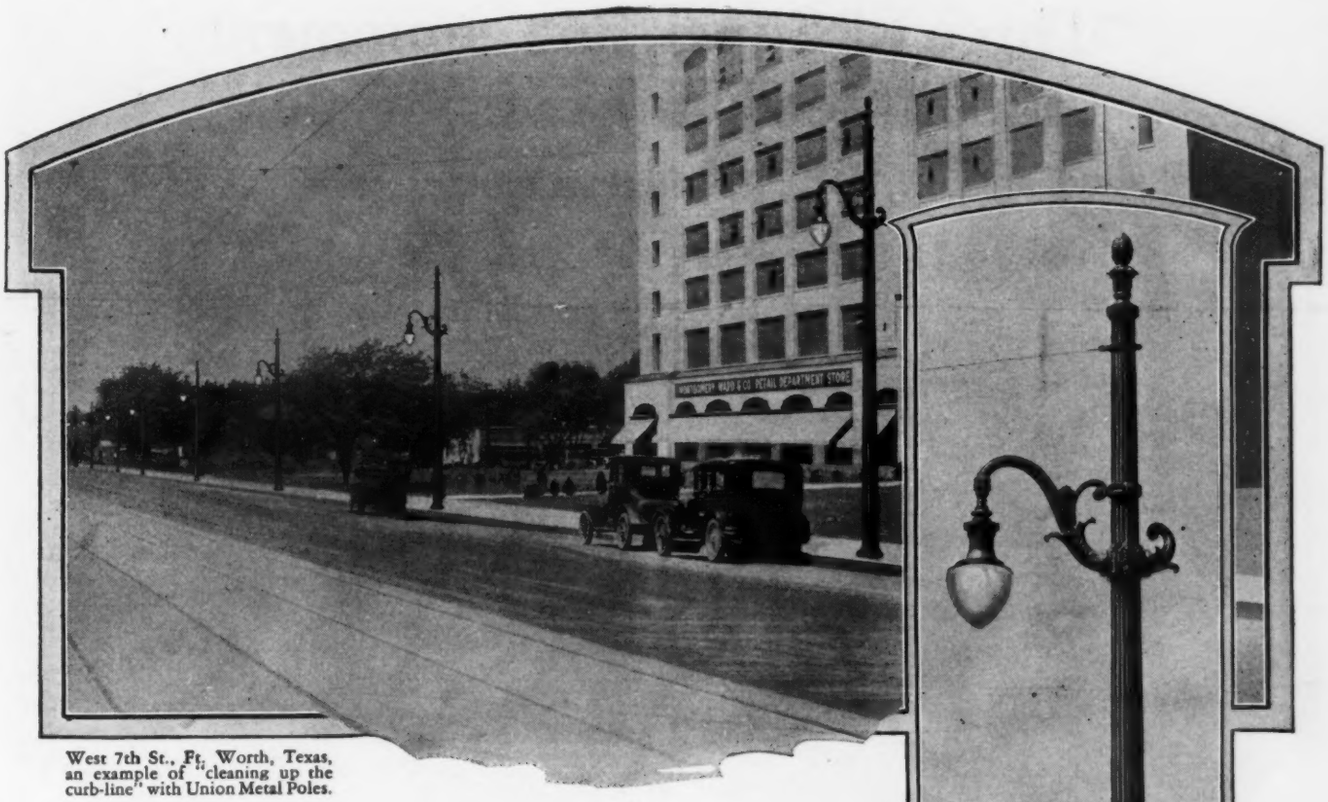


Type TTR—for all heavy duty purposes where vertical opening is permissible—up to and including 220 KV. —all mountings.



Type TTT—double break, shuntless switch—all voltages up to and including 220 KV. Illustration shows a 2000 ampere design.





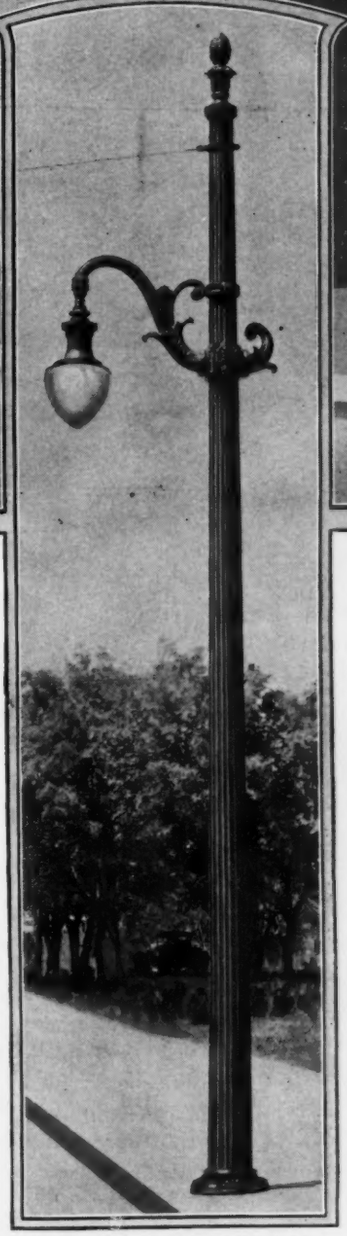
West 7th St., Ft. Worth, Texas, an example of "cleaning up the curb-line" with Union Metal Poles.

If Street Appearance Means Anything—

IN these days of the City Beautiful and civic plan commissions, stress is continually placed on street appearance. And unless thousands of city officials are wrong, clean, well kept streets and avenues are exceedingly important.

Few things are more unsightly than a mass of poles, posts and wires along the curb-line. Ft. Worth was one of many cities to realize this. And so, on West 7th Street, Union Metal Poles were installed recently to carry the trolley span wires and lighting units. The result is a dignified and attractive street. Needless to say, the utilities sponsoring the installation received no little credit from the public for their move.

In other cities Union Metal Fluted Steel Poles are used for carrying transmission and distribution lines, trolley span wires, traffic signals and street lights—one set of poles for all purposes.



Union Metal Fluted Steel Pole equipped with No. 4511 bracket as used in Ft. Worth, Texas.

Distributed by Graybar

THE UNION METAL MANUFACTURING CO.

General Offices and Factory, Canton, Ohio

Sales Offices—New York, Chicago, Philadelphia, Cleveland, Boston, Los Angeles, San Francisco, Seattle, Dallas, Atlanta.

Distributors:

Graybar Electric Company, Incorporated — General Electric Merchandise Distributors

Offices in all principal cities

Union Metal will exhibit in Space No. 624 at the A. E. R. A. Convention, Atlantic City, Sept. 28—October 4.

UNION METAL

DISTRIBUTION AND TRANSMISSION POLES

"Three E" Super-fine equipment meets needs for every type of substation

Here's why "Three E" Equipment meets the particular needs of your service conditions:

It is engineered for easy expansion.

It is made for the user's best advantage.

It is built of the best materials, by skilled workmen in a modernly-equipped, daylight factory.

It is particularly constructed to be most serviceable under every operating condition including weather.

There are no inefficiencies of construction to require maintenance and replacements and reduce the service life.

This 132000/66000/4000 volt substation was built for The Illinois Power Company at East Springfield, Illinois and was "Three E" equipped.

Put your outdoor substation problems up to "Three E".

* *"Service Value"* = **Low cost per year of service.**

ELECTRICAL ENGINEERS EQUIPMENT CO.

General Offices and Factory: Melrose Park, Ill.

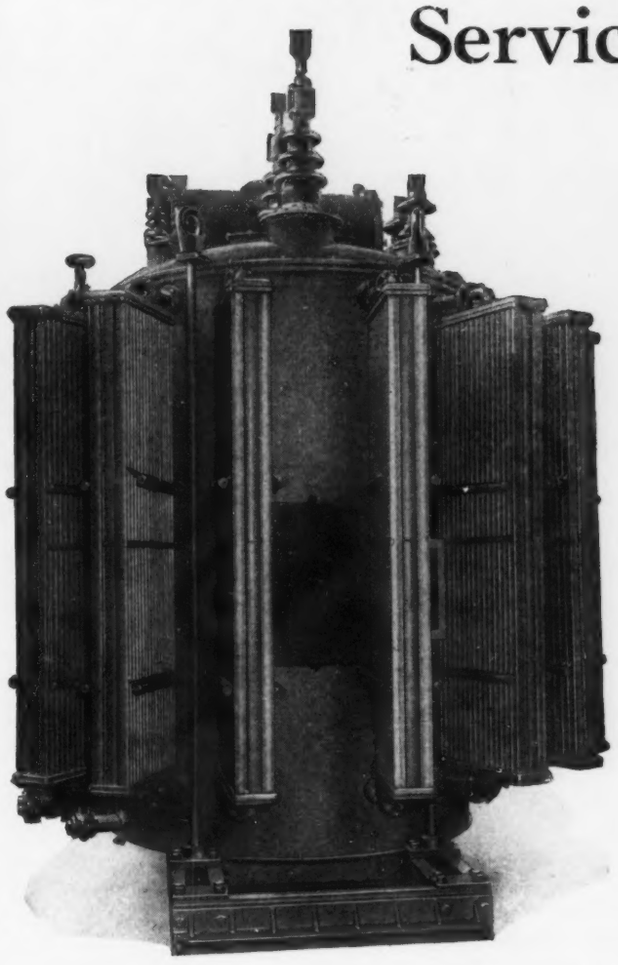
Chicago Office: 205 W. Wacker Drive Eastern Office: 21 Park Row, New York

Sales Offices in all principal cities

Canadian Representative Northern Electric Company LIMITED

It Pays to use the THREE Catalog

This 20,000-kva. Transformer —meets a Wide Variety of Service Conditions



—Allis-Chalmers electrical equipment includes machinery for the generation, transformation, conversion and utilization of electric power.

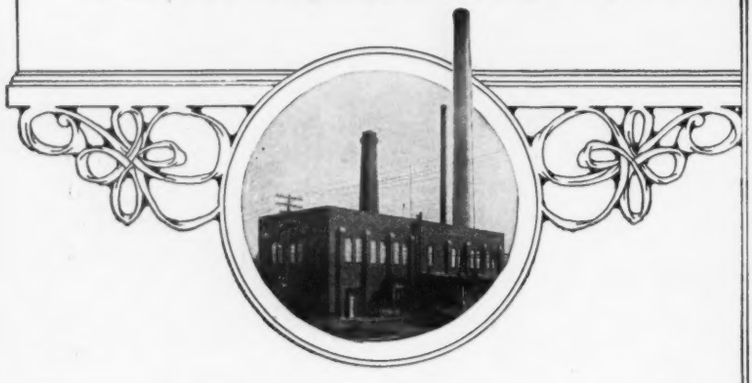
THE transformer pictured here is one of three rated at 20,000 kva., 66,000 volts, high side and 12,000 volts, low side. In addition it is equipped with a tertiary winding developing 7,500 kva., at 2,300 volts. Arranged for auxiliary cooling; blasts of cooling air are forced up through the radiators from the nozzles in the pipes located on each radiator. These transformers will carry two-thirds load without forced air. They are also arranged to carry full load with auxiliary water cooling, or external oil cooling in place of the forced air.

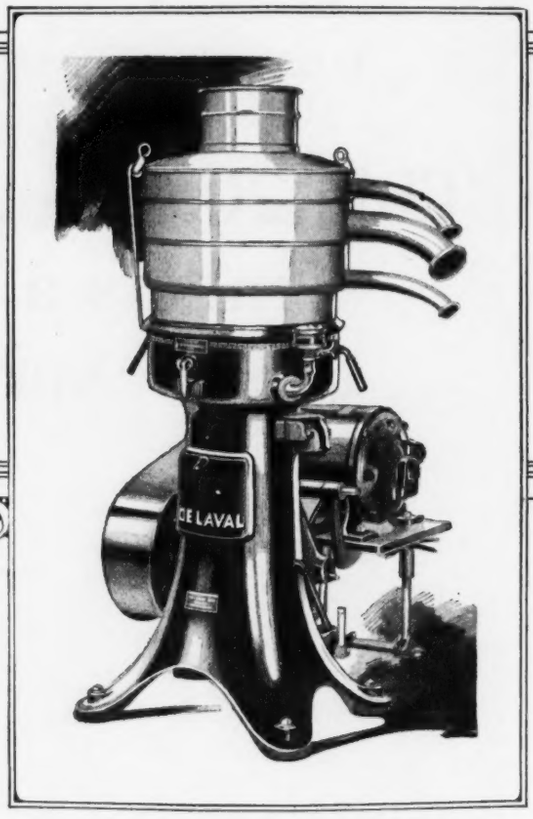
Allis-Chalmers pioneered in the development of modern high voltage transformers permitting the development of modern super-power stations and the economical transmission of power over long distances. Since that time transformer design has kept abreast of modern requirements and today Allis-Chalmers is building transformers of many types, for a wide variety of service conditions.

Allis-Chalmers Mfg. Co.
Milwaukee, Wis.

ALLIS-CHALMERS

Why do operators of small power plants prefer the De Laval, too ?





THE fact that more than 91% of America's greatest electric power systems use the De Laval Oil Purifier, proves that it is preferred by "big business." Why do the vast majority of smaller power systems and industrial plants operating oil purifiers also use the De Laval?

The man who buys equipment for such plants is often spending *his own money,* and thinks of oil purification as something to increase the net profits of the business.

In most cases, he realizes that the saving of oil effected by purification is of secondary importance. The big saving is in *better lubrication,* and this depends upon the ability of the oil purifier to do a *thorough* job . . . to make the purified oil as nearly as possible equal to new . . . to remove impurities from the oil at such a rate as to keep in prime condition all of the oil in the lubricating system.

Still he expects to purify oil at the lowest possible cost. Expecting durability, dependability and low operation and maintenance cost, he inquires carefully into the mechanical construction of various models.

As a result he buys not *an* oil purifier, but *the* Oil Purifier—a De Laval.

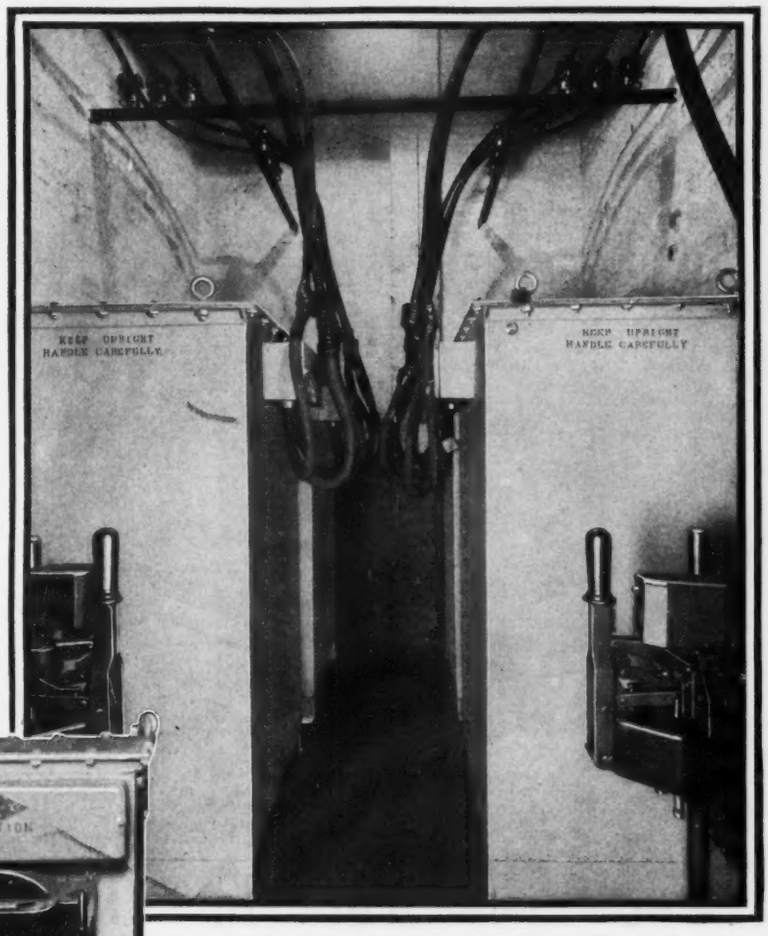
To convince yourself that a De Laval is better for your plant, too, write for Bulletin 106-W on lubricating and fuel oil, or 107-W on insulating oil.

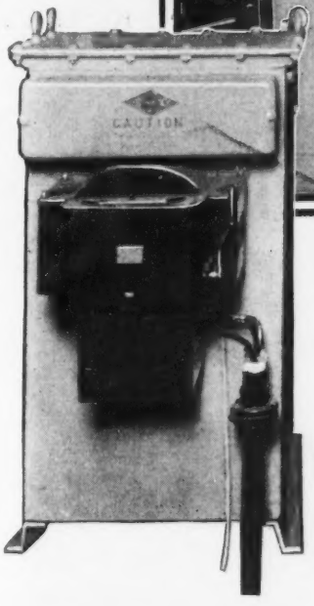
THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 600 Jackson Blvd., Chicago
DE LAVAL PACIFIC COMPANY, San Francisco
ALFA-LAVAL CO., Ltd., 34 Grosvenor Road, London, S. W. 1

DE LAVAL OIL PURIFIERS

Types for Lubricating Oil and Insulating Oil

Six Problems...
Solved by One Simple Decision





E-M Capacitors are compact, weather-proof and fool-proof. They serve for years without attention — paying for themselves many, many times in their long life.

AN Eastern manufacturer* had five problems in regard to electric power:

1. Their transformers were running hot.
2. Their motors were running hot.
3. Their voltage was off . . . 20 volts low.
4. Their motors were running slow.
5. They were paying more than necessary for electric power.

Investigation showed that all five problems were due directly to poor power factor . . . that a Capacitor would solve all of them. And there was where the sixth problem arose.

Logically, any Capacitors had to be installed in the transformer room at the plant. And that room had only a very limited amount of space available for additional apparatus. Not only was it necessary to select a very compact Capacitor—but a most reliable type was needed as the cramped quarters made repairs or service work difficult.

The answer to these six problems? There was only one . . . a *genuine* E-M Capacitor. *Alone,* it met every need.

Because of its patented multiple cylindrical roll construction (multiple rolls all in one tank) it required no more room than a transformer; fitted the space with ease. Because of this same construction — and the sealed case made this possible—it could be put away and forgotten.

It has been . . . for over a year . . . except for the savings it has brought.

Your plant, too, may find worthwhile savings in an E-M Capacitor. Why not investigate? Our trained engineers working out of 40 principal cities will be glad to help — without obligation. Call on them. Also be sure to read our interesting book "Reducing the Cost of Electric Power". Write for a copy today.

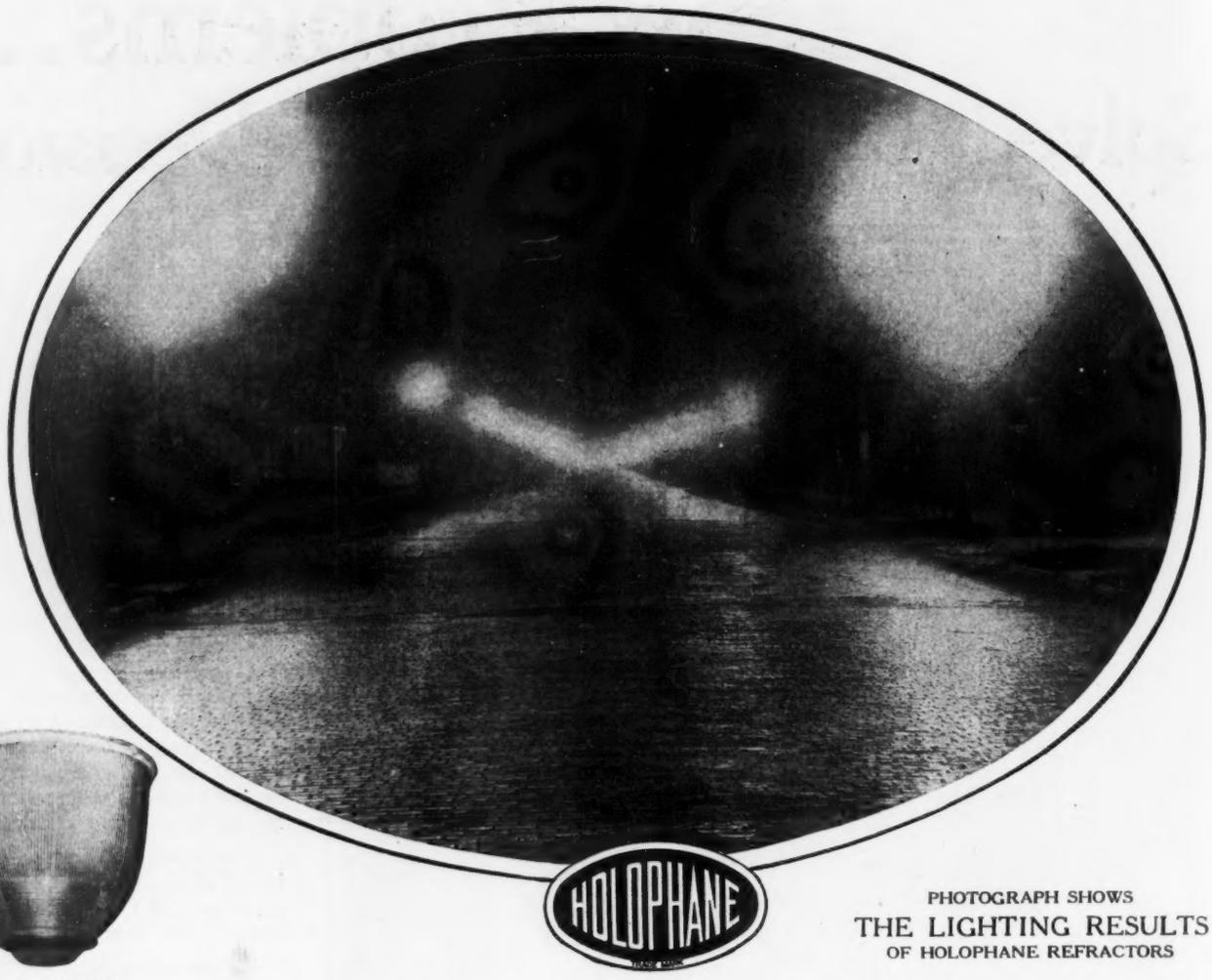
*Name on request

Electric Machinery Mfg. Company
Specialists in Apparatus for Power Factor Improvement
1339 Tyler St., N. E. Minneapolis, Minn.

EM *Power Factor Improvement* CAPACITORS

STATIC CONDENSERS FOR IMPROVING PLANT ELECTRICAL CONDITIONS

(1037)



PHOTOGRAPH SHOWS
THE LIGHTING RESULTS
OF HOLOPHANE REFRACTORS

THE UNIT

PLANNED LIGHTING

WITH HOLOPHANE SPECIFICS

FOR STREETS-HIGHWAYS & PARKS

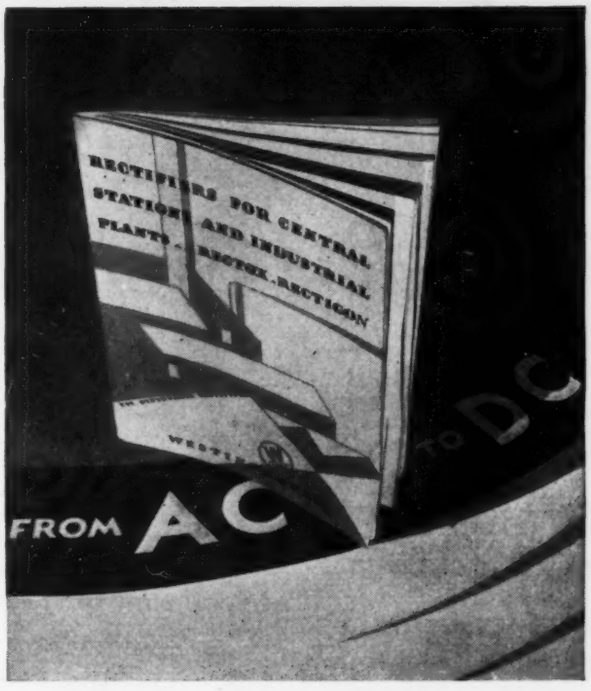
WRITE FOR DATA "PLANNED STREET LIGHTING"

HOLOPHANE CO., INC.

342 MADISON AVE., NEW YORK CITY

SAN FRANCISCO CHICAGO MILWAUKEE TORONTO
PHILADELPHIA BALTIMORE ST. LOUIS SYRACUSE HARTFORD
CHATTANOOGA LOS ANGELES BOSTON CLEVELAND CINCINNATI

THIS *Book* THROWS NEW LIGHT ON THE SIMPLEST ROUTE FROM *A·C* TO *D·C*



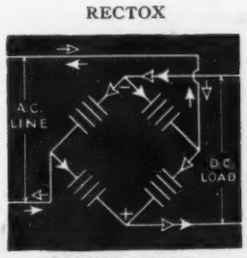
A copper disc, coated on one side with copper oxide, allows electricity to pass in one direction only. That is the basis of copper-oxide rectification. It is the most satisfactory way to furnish DC current from an AC supply because there is no electrolytic or chemical action. Units on life test show no tendency to wear out or deteriorate.

An electrical bridge is constructed of these copper-oxide disc units and combined with the proper transformer in a Westinghouse Rectox rectifier. Oscillographs show that it has no reverse current leakage and no irregularity of wave forms.

A book that applies Rectox to your needs

Rectifiers with a wide range in capacity and for various applications in industrial, central station and telephone installations are described in a new publication that is yours for the asking. Learn, from this book, how Rectox can help you solve your rectifying problems by providing a method that operates without maintenance cost, without failure, without the need of attendance or supervision. Westinghouse Rectigon rectifiers are also described and their uses outlined in this publication. Send in the coupon for your copy of this book.

RECTOX



COPPER-OXIDE RECTIFICATION

Westinghouse

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
Rectifier Section
East Pittsburgh Works East Pittsburgh, Pa.
Sales Offices and Service Shops in All Principal Cities

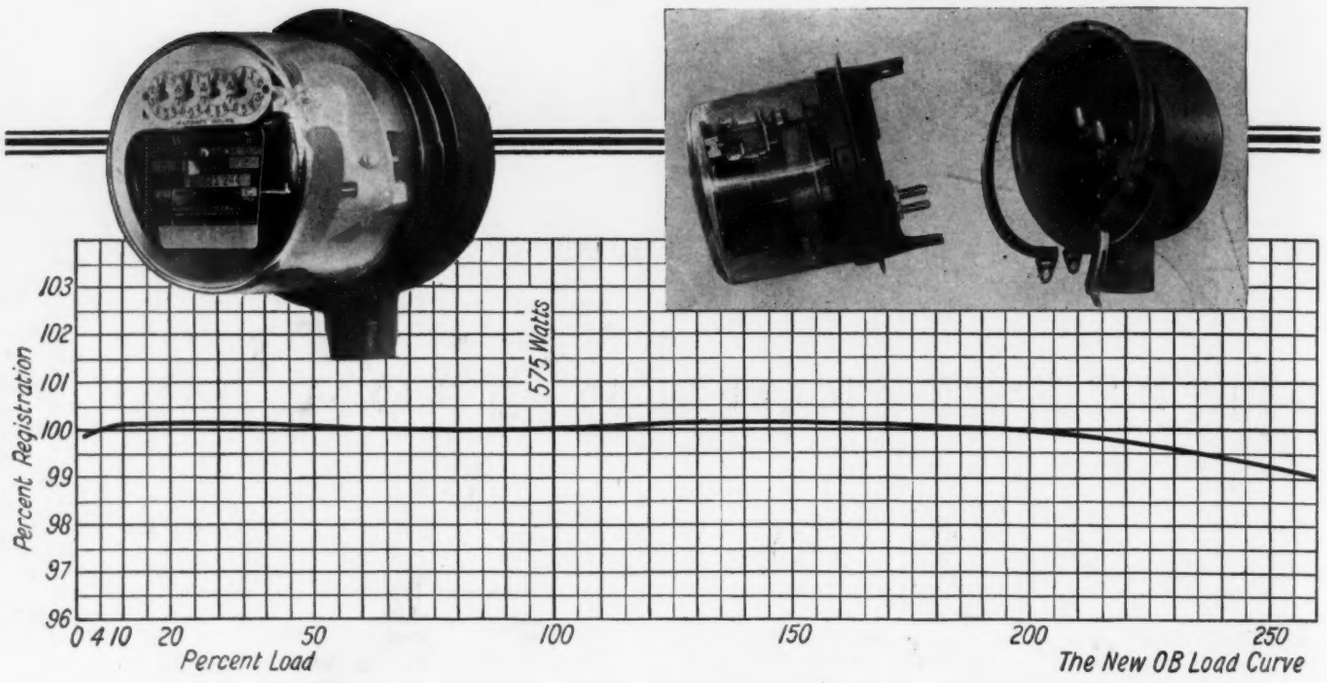
Westinghouse Electric & Mfg. Co.,
Rectifier Section,
East Pittsburgh, Pa.

Please send me a copy of the publication, Rectifiers for Central Stations and Industrial Plants.

Name.....

Company.....

Address.....



The New OB Load Curve

OB Detachable Meter ⟨ *Indoor* / *Outdoor*

with the same overall accuracy

OB Detachable Watthour Meters have the following superior features of the standard, temperature-compensated OB watthour meter:

—superior overall accuracy,

—ability to register accurately under all load conditions,

—low internal losses,

—ability to start at very light loads,

—capacity for overloads.

In addition, it has these unprecedented features:

—suitable for mounting in any location, outdoor or indoor;

—ease of installation or removal; it can be plugged into place or removed in a moment like a radio tube;

—reduction of labor, reading, and testing costs;

—completely iron-clad and tamper-proof;

—greater safety and security with less auxiliary apparatus.

Our meter specialist in the Westinghouse district office near you is at your service. Write for Leaflet No. 20433 which contains facts of special interest.

WESTINGHOUSE ELECTRIC & MFG. COMPANY
NEWARK WORKS NEWARK, N. J.
SALES OFFICES AND SERVICE SHOPS IN ALL PRINCIPAL CITIES OF THE UNITED STATES

Westinghouse

T 30783

No. 601 recommended working load, 3500 lbs. Rated combined M. and E. strength, 10,500 lbs. Reserve strength ratio, 3:1.

Porcelain Insulators with Strength-in-Reserve

PORCELAIN
YOU CAN
INSTALL
AND
FORGET

PORCELAIN is porcelain and insulators are insulators. Yet one insulator holds and another fails. One is, "Porcelain you can Install and Forget"—the other courts failure and peril when subject to unexpected strain.

Why the difference?

This question is answered by these facts:

Science—not tradition—governs the making of all Westinghouse porcelain and insulators. Precision processes at every stage are the rule. Never is anything taken for granted. We even compensate for natural variations in the raw materials.

First the design—then the materials—then the method—and then, a vigilance that permits no compromise. These are the reasons why you can install and forget Westinghouse porcelain.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
DERRY (PA.) WORKS EMERYVILLE (CALIF.) WORKS
SALES OFFICES IN ALL PRINCIPAL CITIES OF THE UNITED STATES AND FOREIGN COUNTRIES

Westinghouse

T 30685

New Issue

50,000 Units
EMPIRE CORPORATION

In the form of Allotment Certificates

Each Unit Consisting of

One Share Cumulative Convertible Preferred Stock
$3 Optional Dividend Series
One Share Common Stock—One Option Warrant

Each share of Preferred Stock of this series is convertible at the option of the holder thereof at any time after March 1, 1930, up to and including the second day prior to the date fixed for redemption into two and one-half shares of Common Stock.

Provisions for adjustment of the conversion and stock dividend rates and the number of shares deliverable on the exercise of Option Warrants in the event of split-ups, combination of shares and certain Common Stock dividends are set forth in the Certificate of Incorporation and other instruments respecting this Series of Preferred Stock and the Option Warrants. Preferred Stock of this Series is redeemable at the option of the Corporation at any time in whole or in part on thirty days' notice by mail at and entitled on liquidation to receive in preference over the Common Stock, $55 per share and accrued unpaid dividends in cash. Each holder of Preferred Stock shall have one vote for each share of such stock held by him and each holder of Common Stock shall have one vote for each share of such stock held by him.

TRANSFER AGENTS:
The Equitable Trust Company of New York

REGISTRAR:
The Chase National Bank of the City of New York

The following information has been summarized from a letter of Mr. Floyd W. Woodcock, President of the Corporation, to the Bankers:

COMPANY: Empire Corporation has been formed under the laws of the State of Delaware to acquire controlling interests and otherwise to invest in public utility enterprises and to exercise such other of its Charter Powers as its Board of Directors may from time to time determine. It is expected that its principal operations will be the acquisition of majority or substantial minority holdings in the common stock equities of public utility holding and operating corporations with a view to aiding in and benefiting by the growth and development of such companies. It is contemplated that the Corporation's executives will be active in the management of those Companies in which the Corporation has a majority interest. The Corporation has acquired, *through an exchange of its Common Stock*, voting trust certificates for over 87% of the outstanding Class B Common Stock of Empire Public Service Corporation, a public utility holding company, organized under the laws of the State of Delaware. It is estimated that the value of such voting trust certificates is over twice the amount of the proceeds of this financing. The combined assets of Empire Public Service Corporation and its subsidiaries are estimated to be in excess of $35,000,000 and the gross income thereof for the year ending June 30, 1929, was in excess of $6,750,000; and it also has contracts to purchase common stocks of companies which own directly or indirectly public utility properties estimated to have a value in excess of $7,500,000, with gross income for the year ending June 30, 1929, of over $1,000,000. Upon the completion of this financing, and the sale of certain additional shares of its Common Stock and Option Warrants to be presently sold, Empire Corporation will have total assets estimated by the management to have a value in excess of $9,500,000 including the amount of approximately $3,700,000 in cash. Of said amount of cash it is proposed that approximately $500,000 will be made available to Empire Public Service Corporation in connection with the acquisitions referred to above, the balance of $3,200,000 being available for further acquisitions and other proper corporate purposes.

CAPITALIZATION
(Upon completion of present financing)

	Authorized	To be outstanding
Preferred Stock (no par value)	500,000 Shares	50,000 Shares*
Common Stock (no par value)	2,500,000 Shares**	561,275 Shares***

* Cumulative Convertible Preferred Stock $3 Optional Dividend Series.
** There are to be reserved the number of shares required for conversion of the Preferred Stock of this series and for the 370,000 Stock Option Warrants, to be presently outstanding.
*** Based on the ownership of voting trust certificates for 87% of the outstanding Class B Common Stock of Empire Public Service Corporation, as above. After making allowance believed to be adequate for an exchange of stock of the Corporation for the balance of the presently outstanding Class B Common Stock of Empire Public Service Corporation, or voting trust certificates therefor, there would be outstanding 626,150 shares if the Corporation should acquire 100% of said Class B Common Stock, or voting trust certificates therefor.

EARNINGS: The earnings of Empire Public Service Corporation and its subsidiaries on a consolidated basis for twelve months ending June 30, 1929, applicable to its Class B Common Stock after annual interest and dividend requirements on the prior securities and provision for retirement reserve and taxes (except Federal income tax and amortization of debt discount and expense) and after certain adjustments based on estimates of the management for non-recurring expenses and estimated income on two small properties for part of the year were $197,607 and on the same basis earnings applicable to the voting trust certificates for Class B Common Stock held by Empire Corporation were $172,027. Such latter sum, together with a return estimated at 6% per annum on the balance of $3,200,000 in cash to be received by Empire Corporation through this financing and the sale of certain additional shares of its Common Stock and Option Warrants to be presently sold, would be $364,027, which amount is over 2.4 times the annual preferred dividend requirement on this issue of Preferred Stock if paid in cash.

STOCK DIVIDENDS AND CASH OPTION: Holders of Preferred Stock of this series are entitled, in preference over the Common Stock, to receive cumulative dividends in Common Stock of the Corporation at the quarter yearly rate of one-sixteenth of one share of Common Stock per share of Preferred Stock, or, at the option of the holder thereof, to receive cash at the cumulative quarter yearly rate of $.75 per share. Dividends payable quarterly, when and as declared, on the first days of March, June, September and December.

OPTION WARRANTS: Each Option Warrant will entitle the holder thereof to purchase one share of Common Stock of the Corporation at any time after March 1, 1930, and on or before September 1, 1939, as follows: After March 1, 1930, to and including September 1, 1930, at $14 per share; thereafter to and including September 1, 1933, at $17 per share; thereafter to and including September 1, 1936, at $21 per share, and thereafter to and including September 1, 1939, at $26 per share.

MANAGEMENT: The operation of the properties controlled by Empire Corporation is under the direction of Floyd W. Woodcock President. Mr. Woodcock has a long and successful record as a public utility executive. As a Vice-President of Day & Zimmermann, Inc., he had charge of all public utilities under their management for eight years. The Board of Directors will include the following:

JOHN H. BARRETT
President, Real Estate Mortgage Co. of Baltimore, Baltimore
H. M. CAMERON
Associate Editor, "The Electrical World", New York
ARTHUR DEANE
Singer, Deane & Scribner, Inc., Pittsburgh
A. S. DEWING
Professor of Economics, Harvard University, Boston
W. FINDLAY DOWNS
President, Day & Zimmermann, Inc., Philadelphia
E. A. FELDTKELLER
Vice-President, Empire Public Service Corp., Chicago
EDWARD M. FITCH
Fitch, Crossman & Company, Philadelphia
ARTHUR BESSE
Hale, Waters & Company, New York
J. P. HARRIS
Vice-President, Union Trust Company, Cleveland
J. LEWIS HENRY
Biddle & Henry, Philadelphia
VAL B. HOLMAN
Holman, Watson & Rapp, Philadelphia
RICHARD C. HUNT
Chadbourne, Hunt, Jaeckel & Brown, New York
J. A. W. IGLEHART
J. A. W. Iglehart & Company, Baltimore
Members, N. Y. Stock Exchange
PHILIP C. KEMP
Simpson, Thacher & Bartlett, New York
C. S. NEWHALL
Executive Vice-President, Pennsylvania Company for Insurances on Lives and Granting Annuities, Philadelphia
W. BRUCE PIRNIE
Pirnie, Simons & Co., Inc., Springfield, Mass.
ROBERT W. REA
Formerly President, Southern Ohio Public Service Corporation, Philadelphia
RAYMOND SOUTHWORTH
Southworth, Dierdorff & Company, New York
HAROLD C. YEAGER
Yeager, Young & Pierson, Inc., New York
EZRA WHITMAN
Consulting Engineer—Former Chairman, Public Service Commission of Maryland, Baltimore
J. REANEY WOLFE
Townsend Scott & Son, Baltimore
FLOYD W. WOODCOCK
President, Empire Corporation, Philadelphia
FRED W. YOUNG
President, Atlantic Gas & Electric Company, Boston

Legal matters in connection with the above issue will be passed upon for the Corporation by Messrs. Chadbourne, Hunt, Jaeckel & Brown, New York City, and for the Bankers by Messrs. Seibert & Riggs and Messrs. Simpson, Thacher & Bartlett, New York City. The books and accounts of Empire Public Service Corporation have been audited as of June 30, 1929, by Messrs. Arthur Young & Company. The above units are offered in the form of Allotment Certificates when, as and if issued and accepted by us subject to prior sale and change in price and to approval of Counsel, exchangeable for definitive Preferred Stock certificates and Common Stock certificates and Warrants on and after March 1, 1930. It is expected that Allotment Certificates will be ready for delivery on or about September 25, 1929.

Price $58 per Unit and Accrued Cash Dividend

50,000 shares of Common Stock, No Par Value, are also being offered at $14 per share.

Yeager, Young & Pierson, Inc. **Hale, Waters & Company**

Pirnie, Simons & Co., Inc.

The information and statistics herein contained are not representations by us, but have been obtained from official sources which we believe are reliable.

The Experience of Others —*Use It!*

"No man, other than a genius, can hope to crowd into his own personal experience during his few years of productivity, all the information needed for his progress—nor need he, when the experiences of others are so readily available."

—and genius knows

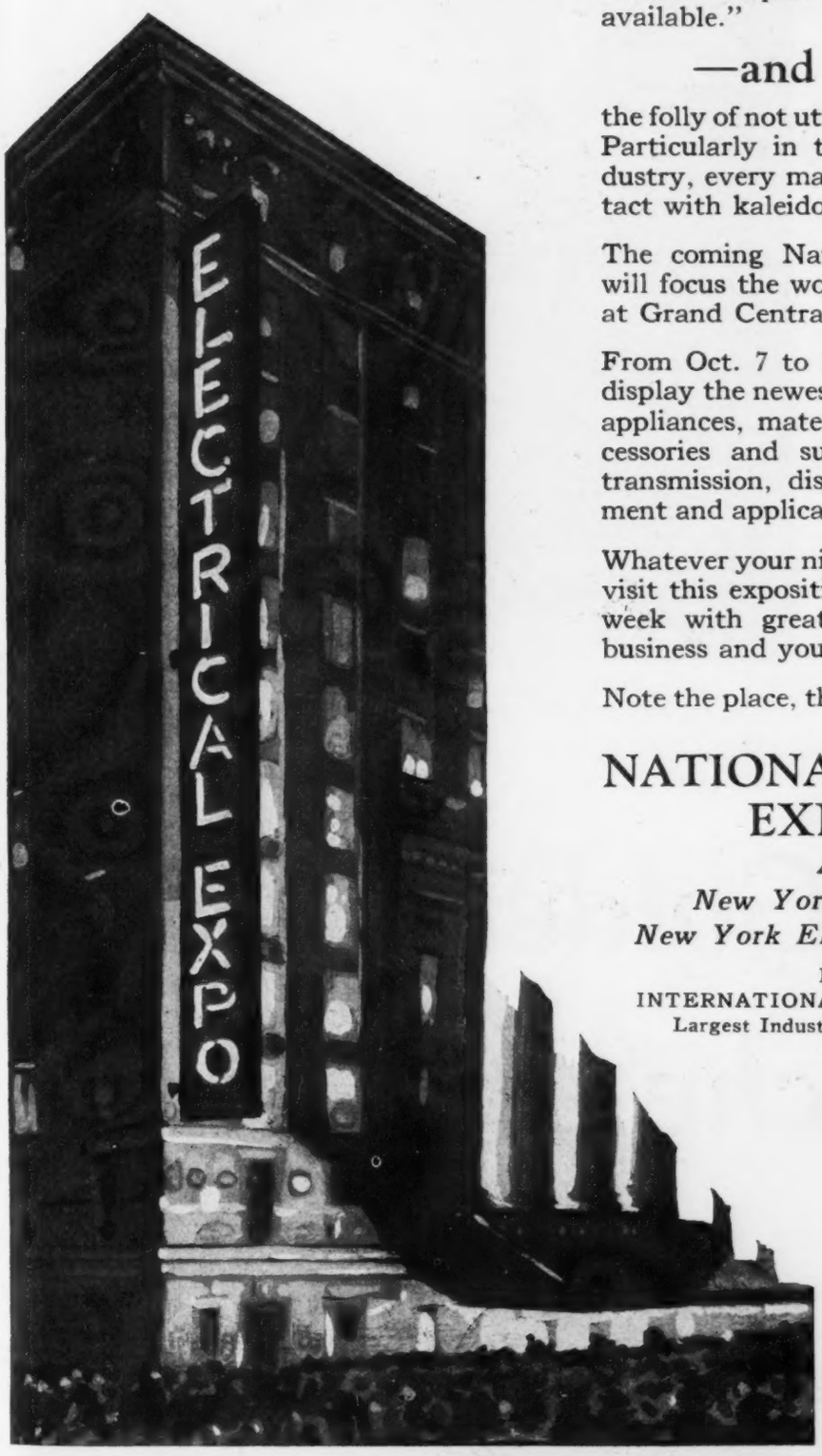
the folly of not utilizing the world's experience. Particularly in the still young electrical industry, every man needs to keep ever in contact with kaleidoscopic changes.

The coming National Electrical Exposition will focus the world's electrical achievements at Grand Central Palace, New York.

From Oct. 7 to 12 this great exposition will display the newest and best of the equipment, appliances, materials, instruments, tools, accessories and supplies for the generation, transmission, distribution, control, measurement and application of electrical energy.

Whatever your niche in the electrical industry, visit this exposition. You could not spend a week with greater profit to yourself, your business and your industry.

Note the place, the date—and come.



NATIONAL ELECTRICAL EXPOSITION

Auspices of
New York Electrical League
New York Electrical Board of Trade

Management of
INTERNATIONAL EXPOSITION COMPANY
Largest Industrial Exposition Organization
in the World.

Grand Central Palace New York

October 7 to 12 1929

3752

The Miracle of 1879

Henry Ford receives Thomas Edison's original lamp factory from the General Electric Company at Mazdabrook, N. J.

Light's Golden Jubilee Approaches Its Climax

The World Honors Thomas Alva Edison

SCARCELY more than a month away, growing to proportions beyond the fondest hopes of its inspired inceptors, the epochal climax to LIGHT'S GOLDEN JUBILEE approaches.

From the birth of the Jubilee idea last February, when the Edison Pioneers celebrated the master inventor's eighty-second birthday, to its gigantic culmination on the night of October 21—eight short months. But in eight months the nation will have summoned every faculty, and will stand ready to demonstrate unforgetably its appreciation to Thomas Alva Edison for his invention, 50 years ago, of the first practical incandescent electric lamp.

The part of the electrical industry in the nation-wide tribute is a glorious one. The world, eager to honor Edison, is taking its cue, these days, from the electrical industry. The world *needs* only a cue. For Thomas Alva Edison, father of the electrical industry and banisher of human burdens, is this year the nation's hero.

Your part in LIGHT'S GOLDEN JUBILEE is doubtless planned. Carry it through, gloriously. Overlook no opportunity to help your community to celebrate magnificently.

For the world is eager to honor Thomas Alva Edison. *Your* initiative is the deciding factor.

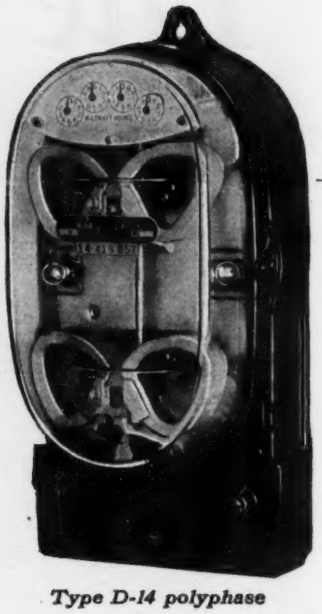
EDISON MAZDA LAMPS
General Electric
HARRISON, N. J.

NATIONAL MAZDA LAMPS
CLEVELAND, OHIO

The Miracle of 1929

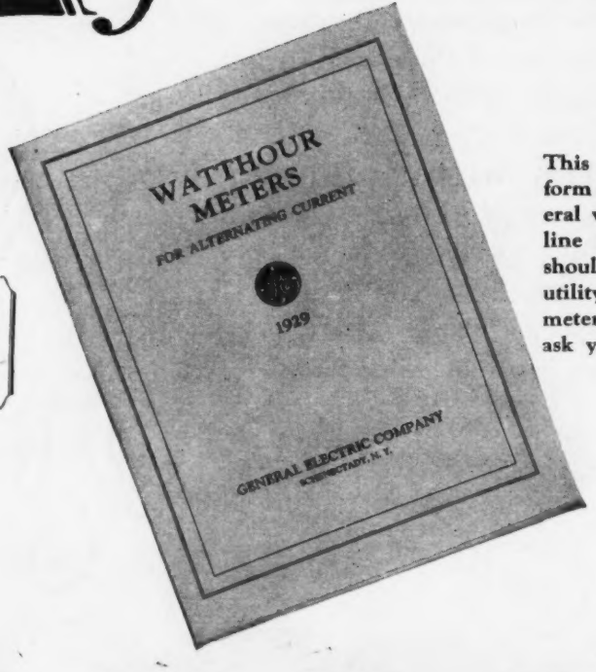
Type I-16 single-phase

Type I-18 two-element, three-wire



Type D-14 polyphase

A full line of

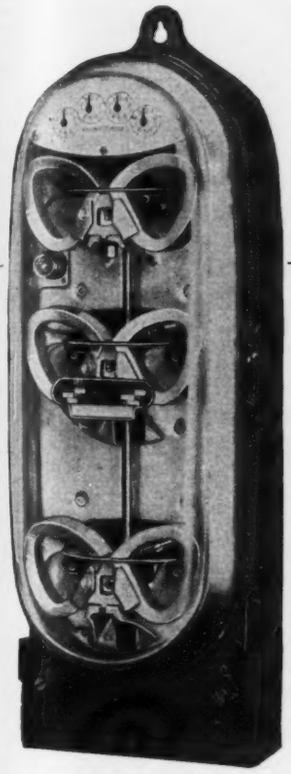


This catalog presents in convenient form a complete description of the several watthour meters of this new G-E line and gives ratings and prices. It should be in the hands of all public utility men interested in watthour meters. If you have not received a copy, ask your G-E office for No. GEA-1183.

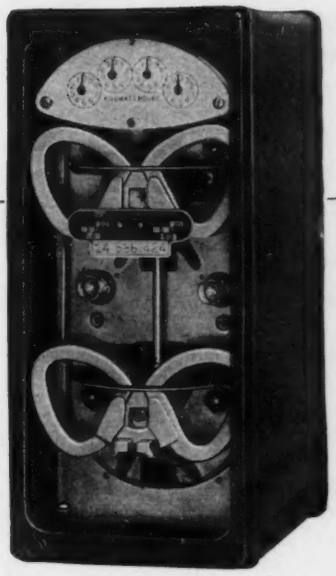
JOIN US IN THE GENERAL ELECTRIC HOUR, BROADCAST EVERY SATURDAY AT 9 P.M., E.S.T. ON A NATION-WIDE N.B.C. NETWORK

GENERAL

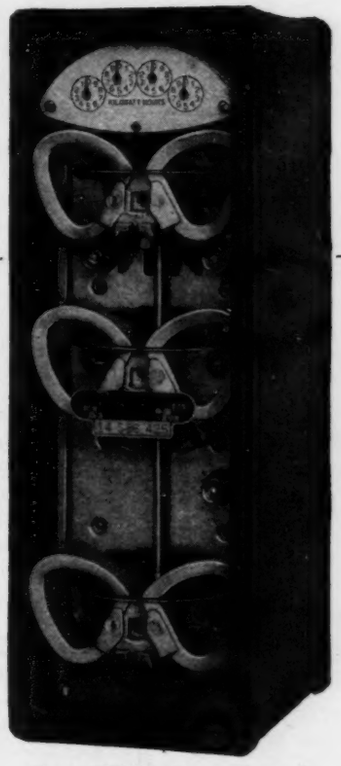
GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.



Type D-15 three-element, polyphase



Type DS-19 polyphase, back-connected



Type DS-20 three-element polyphase, back-connected

a-c. watthour meters
with I-16 characteristics

THE I-16 watthour meter was an innovation in many respects. Now you can take advantage of its notable characteristics in the meters for other than single-phase work. These give you the same long-range accuracy, and a high standard of accuracy at extremes of temperature, under changing circuit conditions, and at light loads as well as on overloads. The mechanical refinements of the I-16 are also carried out to a striking degree. Among these are the methods of attaching covers, the sealing arrangements, and the various calibrating adjustments—all worthy contributions to the meter art.

600-26

ELECTRIC

SALES OFFICES IN PRINCIPAL CITIES

Poetry of Research

I salute the workers in physical research as the poets of today. It may be that they do not write in verse, but their communications are of such lively interest that they are on the front pages of our newspapers and command space in agricultural periodicals. They appeal to the imagination of us all. They contribute the warming glow of inspiration to industry, and when industry pulls their ideas down from the heavens to the earth and harnesses them for practical service, it, too, feels that it is an important actor, not only in the makings of things but on the larger stage of the human spirit. There may be enough poetry in the whir of our machines so that our machine age will become immortal.—Owen D. Young.

PROSE *of* TEST

Between the poetry of research and the inspiration of industry rests a service, prosaic perhaps, since its sole purpose is scientific determination of unglorified FACT.

Neither research nor industry can long prosper without the foundation of FACT.

For thirty years the industry's fact finding organization:

KNOW —by Test

Electrical Testing Laboratories
80th Street and East End Ave.
New York N.Y.

Thirty years in the Service of the Electrical Industry

Electrical World

A McGraw-Hill Publication—Established 1874

L. W. W. MORROW, *Editor*

Volume 94 *New York, Saturday, September 21, 1929* Number 12

Clarity in Stock-Dividend Policy

WHETHER stock dividends capitalize past earning power or represent merely an increase in the number of shares must now be indicated by New York Stock Exchange members whose stock is listed, to conform with a recent Exchange ruling. A true stock dividend represents the capitalization in whole or in part of past or current earnings, the new ruling says. Any other type is equivalent to a split-up and has no necessary relation to earnings. The distinction is made imperative by the growing number of well-established organizations which obtain at least part of their capital requirements through the issue of stock dividends.

The new ruling obviously makes no criticism of the stock dividend as such. The policy has become well established and has much in its favor as a means of keeping capital in the business and at the same time making provision for expansion. The ruling is designed, rather, to prevent misleading accounting practices likely to deceive the investor. It embodies a distinction which, though possibly difficult to maintain at times, is a step toward better corporate finance and is along lines embodied in stock dividends issued by well-established utilities.

❖

Do We Need So Many Varieties?

THE diversity of practice shown in the recent transmission-line survey made by the Electrical World, of which the results are presented in the supplement accompanying the present issue, suggests the possibility of greater standardization without any sacrifice of that freedom in design essential to further progress.

Obviously local conditions must govern. Climate, terrain, accessibility, load density, necessary reliability, probable need of early change, new knowledge of line performance or newly obtainable equipment—these are all factors that have to be taken into account. Nevertheless, there remain groups of cases in which conditions are essentially similar. The present tabulation, produced through the collaboration of many individuals in many organizations, makes possible a comparison whereby similarities may be discovered and a classification established. That is the first step.

It may logically be followed by an analysis to determine whether there is not for each group some one method that might in general be preferred.

The necessary organization and committees to inaugurate such action are already in existence, and the information has been assembled. Engineers are believers in simplification. Here seems to be an opportunity to put it into effect.

❖

Gubernatorial Misconceptions About Water Power

NOTWITHSTANDING that the lack of rain which has been very general throughout the country has had a serious effect on most hydro-electric stations, Governor Roosevelt's faith in the economy and earning capacity of water power is still strong. As a matter of fact, he is more than eager to put the Empire State in the power business, claiming that on at least two occasions the voters have very definitely and unmistakenly expressed their wishes in this regard. Of course, the Governor assumes too much, and fortunately a majority of the citizens of New York still refuse to be misled by his political sophistry, so that there is no deafening clamor for state development. Unfortunately, however, Governor Roosevelt is doing everything possible to undermine the faith of the public in their regulated utilities and in the creature of the state itself, the Public Service Commission, thus casting in his lot with "parlor socialists."

Many still regard Franklin Roosevelt as a business man, and to a business man of his training size should not be appalling. He knows, or should know, that competition leads in its evolution to co-operation and that the final step in co-operation is consolidation. Each of these steps connotes better or cheaper service and shows initiative, enterprise and energy. Out of such qualities have come in the electrical industry of America inventions that amaze, growth that astounds and service that is the envy of the rest of the world. Moreover, the history of hydro-electric development in this country is gloomy instead of roseate. Most developments have led toward penury rather than riches.

Government statistics for this year's water-power output compared with last year's record ought to be convincing evidence of the instability of the water-power business. And if that be not enough, the fact

that the industry whose sole function is to develop and sell electrical energy is turning from water power to steam as a source of energy ought to refute the notion that water power is a bonanza. Even in a district where water-power development is cheapest and at its best, the Niagara peninsula, steam-power station installation will eclipse water-power station installation within the next year. It is chiefly because of interconnection and consolidation that many water-power developments become commercially successful, and yet apparently these very factors, because not understood, cause Governor Roosevelt the most concern.

❖

World Power Conferences Well Justified

THE World Power Conference idea has taken hold and has proved more than a casual movement for the betterment of international engineering relationships. With their customary resort to planning and analysis, the engineers have developed a workable mechanism for international co-operation in engineering and economics. The sectional meeting in Japan this fall and the plenary meeting in Berlin next spring bid fair to mark a new epoch in world power affairs, in that broad economic principles as well as strictly engineering topics will be discussed. A further proof of recognition of the value of the movement is the appointment of O. C. Merrill as head of the American committee with an adequate staff and funds to maintain activities continuously.

Recognition of the importance of the conference is seen also in the participation of leaders of governments in its activities and their cordial support of its plans for further service. The recent trend toward a discussion of economic principles and business practices makes it possible to introduce and discuss new ideas before a most influential audience. This should bring about changes in laws, methods and engineering which will make for greater international standardization.

No country has more to gain by support of the World Power Conference than the United States. It is a vital tool to aid manufacturers develop export business and become acquainted with foreign conditions affecting the manufacture and use of equipment. It should prove of tremendous value to utility chiefs and bankers who have invested money in or purchased foreign properties. At present there is very little agreement between the nations as to laws, taxes, mortgages, trade practices and franchise rights, and some strange and weird handicaps face American business men in their endeavor to invest their funds and introduce their methods in foreign countries. International understanding is needed before developments can be had that will bring to the remainder of the world the same degree of power use and the same mass-production business methods that make this country prosperous.

The Doom of the Electron

DR. IRVING LANGMUIR'S recent statements in a presidential address before a chemical congress will strike dismay into the hearts of persons who have thought that they understood exactly what was going on inside of a vacuum tube and have informed inquirers that electron streams consist of small but actual bullets. Recent discoveries, Dr. Langmuir said, force us to consider the electron as a transient mathematical conception only, having no more reality than the square root of minus one. To the scientist, as well as to the practical engineer, this statement will not sound revolutionary at all. Such men never could consider an electron as anything but a transient mathematical expression. What would one do with a formula any term of which represented electrons? The electrons always had to be eliminated from the formula before it could be applied in practice.

Similes and images and comparisons there must be in science, but it is a mistake to make the public believe that we understand the wave theory by telling them something about throwing pebbles on a lake, or that we understand the phenomenon of a vacuum tube by telling them that millions of little bullets are shooting through it. The public is apt to take such things literally, and when science finds it necessary to modify a theory the public is apt to lose its respect for science. It might be better to tell the public once and for all that it had better make up its mind that it cannot understand such things because it has not devoted many years to the study of physics and infinitesimal mathematics. And, between ourselves, the scientists and engineers are groping in an equally vague realm when they attempt exactness in definitions or physical conceptions of infinitesimals. There is more to fundamental energy than a mathematical formula.

❖

Utility Consolidations Continue

WHAT might be called a regional plan of power development is being brought about in several sections of the country. The latest news brings the Frontier Corporation into the Niagara-Hudson group of utilities, and rumors are rife of mergers and purchases involving the principal utilities in California.

The acquisition of the Frontier Corporation adds an additional unit to the Morgan-Mellon properties in the New York-Pennsylvania-New Jersey area and is a logical step in a program that is based apparently on a regional development of power under the direction of a single management. It paves the way to the full development and use of the St. Lawrence power, although no immediate construction can take place. The need for international agreements and for an adjustment of state and federal rights on the St. Lawrence, and above all, a deadlocked political situation in New York State, offer tremendous handicaps to the im-

mediate use of water-power sites on that river. But when these difficulties are overcome it will be possible to utilize St. Lawrence power in the best possible combination with the loads and other power generating sources of New York State. This, however, will not necessarily involve the much-talked-about transmission to New York City.

There is little doubt that regional developments of power are necessary and logical in the present state of the art and to meet the requirements of good electric service. Maximum economy in operation, maximum extension of service, maximum use of service and minimum cost of service result from grouping plants and lines in a power area under a single co-ordinated and intelligent utility management. The advent of large banking groups into the utility field has been followed by a cessation of battles between rival utility managements for territory and position and by the growth of a partnership basis of action that will be far more constructive, if it is held within the scope of better service.

The Morgan-Mellon movement is a step in advance in utility progress and not added evidence of a "power trust."

❖

Better Welding Through Non-Destructive Tests

SOME of the uncertainties in regard to the strength of welded joints and the craftsmanship of the welder may be rendered less perturbing to the skeptical engineer-designer if the test equipment reported upon at the recent Cleveland meeting of the American Welding Society meets present expectations. The ordinary stethoscope of the physician—provided, however, with a gum-rubber tip to exclude extraneous sounds and give contact on an irregular surface, as well as to minimize damping of oscillations—may be used for the investigation of welded joint strengths. If the point to be tested be struck with a small hammer, a sound is heard which is critical and shows the character of the material at the point struck. Preliminary tests establish the characteristic sounds for each structure.

The Sperry rail-testing device has proved its value for weld inspections offering a rapid, ink record of the soundness of the weld. This device consists essentially of apparatus, moved along the material to be tested, for passing an electric current between two main contact brushes between which are three auxiliary brushes. Current passing from the first to the second passes through a transformer coil, while that from the second to the third passes through a similar coil wound in the opposite direction on the same core. A homogeneous material will be evidenced by an equal current in each coil, each neutralizing the magnetic effects of the other, while lack of uniformity will produce a disturbance in the core which is picked up by the secondary of the transformer and amplified by radio tubes to operate recording or indicating apparatus.

A comparatively inexpensive, reliable method for determining the strength of welded joints is as inevitable as it is necessary. Such a test must be readily applicable to the many variations in size, shape and thickness of the materials involved, and the equipment must be capable of easy transportation for quick tests on the job, relatively inaccessible though it may be. When such a device is perfected, welding will be beyond all serious rivals for metallic joining, for it will be demonstrably certain where riveting, bolting or crimping is of necessity guesswork in no small degree.

❖

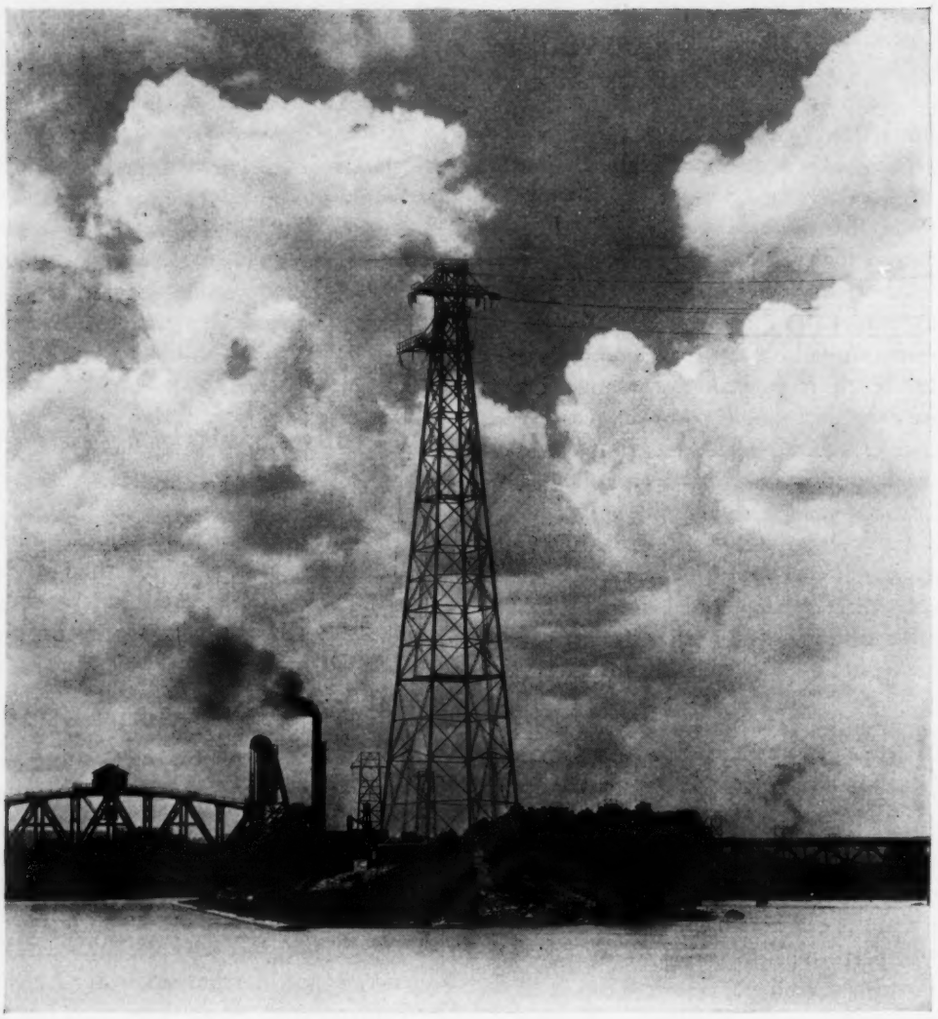
New Sources of Energy Still Sought

CONSERVATIVE individuals have a strong tendency to greet with loud cries and derisive laughter each new method of power generation and application which their more imaginative fellows envision. While Fulton was the jest of "little old New York" the *Clermont* was about to accomplish the definitely "impossible." While Edison devised amazingly clumsy devices for the use of electrical energy as reactionaries scoffed the electrification of America was embryonically on its way. Again, Elwood Haynes and the Wrights were quite mad. Any normal person of thirty or forty years ago knew that.

The skeptics offer excellent reasons, in fine logical style, to explain just why the dream of Georges Claude to generate power from sea water by vapor turbines in the Tropics must go aglimmering, but M. Claude first generates the power practically on a small scale under unfavorable conditions and then courageously starts to build a large plant—12,000 kw.—to prove that the-thing-that-could-not-be-done is no fool's fantasy.

Latest among the torturers of mossbackery is the gentleman who would utilize the electrical energy developed in the photochemical cell, upon alternate exposure to and protection from sunlight, for the useful accumulation and transformation of sun energy for the needs of mankind. The recognized difficulties of small reaction velocities, with consequent low intensity of electrical current, are not insurmountable; for, as pointed out by Prof. F. M. Jaeger, the construction of such cells is wholly a problem of reaction kinetics, and if it should prove possible to devise radiation accumulators in which reversible and very rapid photochemical changes take place, the problem of using solar radiation as a source of energy might be solved.

One fine day humanity will awake to find that the difficulties of transforming solar energy into an economical, continuous and reliable source of supply by one means or another, but without the unconscionable delay of "natural" chemical and physical processes, have yielded to persistence—and a new era will be upon the world. The only impossible things are those which have not as yet been accomplished.

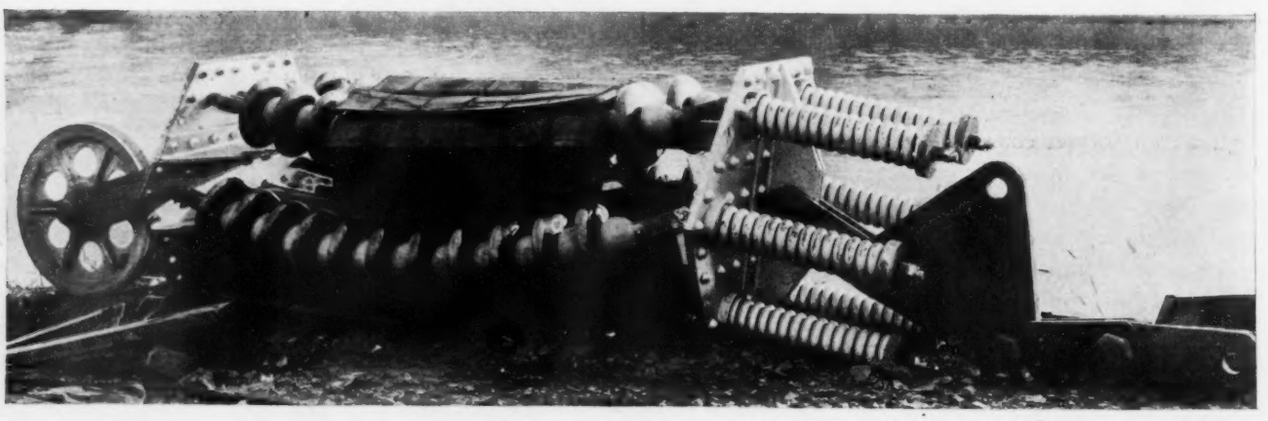


250-Ft. Tower at West End of 3,300-Ft. River Crossing Span

Spanning the Ohio

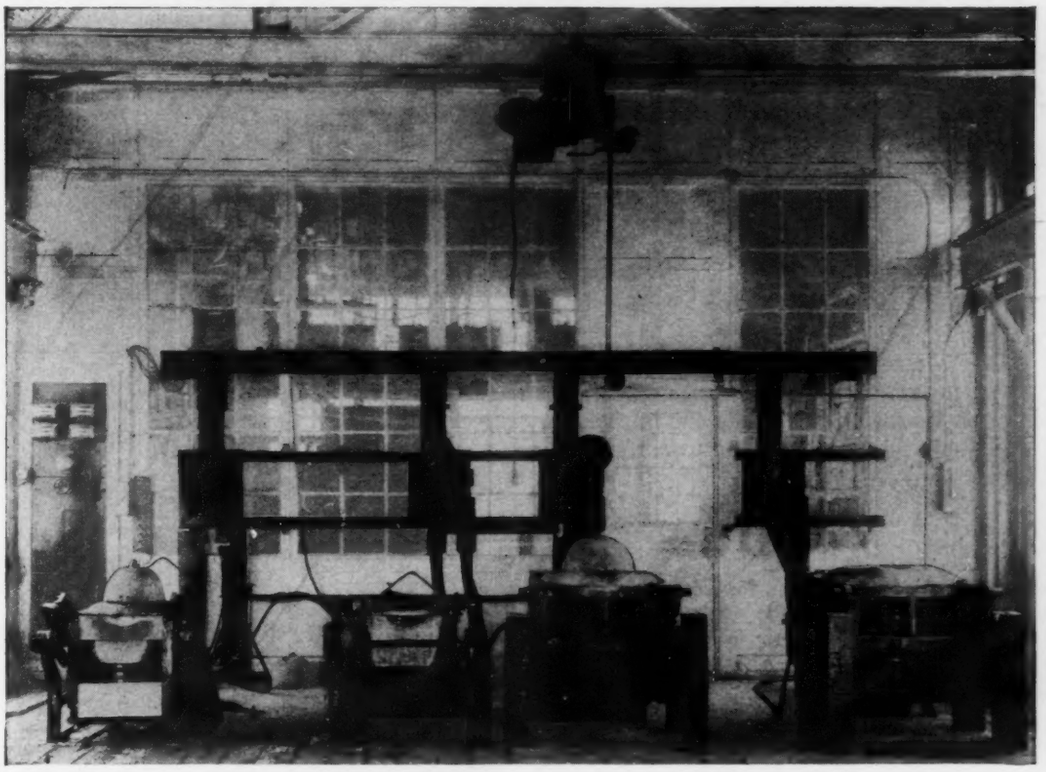
UNUSUALLY heavy construction was required for this 3,300-ft. river crossing span of a 66-kv., 500,000-circ.mil line of the Louisville Hydro-Electric Company. The whole line is only 2.57 miles long, but it connects two power plants of more than 100,000 hp. each—the Waterside steam station and the Ohio Falls hydro station at Louisville, Ky.—and includes this impressive piece of transmission engineering. This is merely one example of the physical realities represented by columns of data in the current Supplement.

Insulator Assembly for River Crossing Tower



High-Frequency Furnaces

Operating experience with Ajax-Northrup coreless induction furnaces in foundry of Babcock & Wilcox Tube Company. Tests, results and operating records



Four Ajax-Northrup Coreless Induction Furnaces in the Beaver Falls Plant of the Babcock & Wilcox Tube Company

THE pioneer foundry installation of Ajax-Northrup coreless induction furnaces was made in January, 1927, at the Beaver Falls plant of the Babcock & Wilcox Tube Company. The equipment has now been in daily production for more than two years and the results and experience that have been obtained are most interesting.

The metals usually melted are of the heat, chemical and abrasion resisting type, requiring pouring temperatures of from 2,900 deg. F. to 3,200 deg. F., and high-speed steel and other alloys are occasionally made. The average daily production of this foundry is 4,000 lb. per nine-hour day, although frequently this is increased to 5,000 lb. per day by running overtime.

The outstanding advantage this installation has shown is its ability to reproduce analyses time after time. For example, in a series of twenty-five consecutive heats of an alloy containing 28 per cent Cr., 8 per cent Ni. and 0.50 per cent C., the variation in Cr. was not over 1½ per cent between the high and the low, the nickel did not vary ¾ per cent from the high to the low and all carbons were within 0.06 per cent. This series of heats was made from miscellaneous scrap, not new metal.

The analysis of a typical series of eight consecutive heats is as follows:

	Minimum	Maximum
C	0.50	0.56
Mn	0.85	0.93
Si	2.44	2.70
Cr	30.6	36.0
Ni	6.36	6.57

These heats were made from miscellaneous scrap and the variation in nickel is strictly due to variation in the scrap.

The following log sheet shows typical results obtained with analysis of scrap charged and analysis of resulting pour:

Heat A Analysis metal charge—19.60 Cr. 8.6 Ni.—0.213 C.
Analysis metal poured—18.00 Cr. 8.96 Ni.—0.19 C.
Size pour—300 lb.
Time to melt—1 hour
Kilowatt-Hours—150
Crucible—Acid—156th Heat

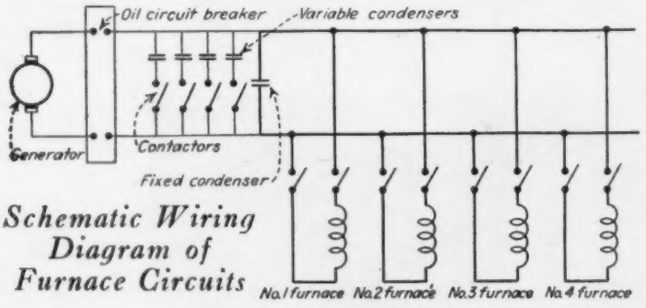
The average time for melting a 1,000-lb. charge of nickel steel is from one hour and 50 minutes to two hours and fifteen minutes, depending on the mixture

and the character of the scrap. The average pouring temperature is 3,000 deg. F.

On the 400-lb. furnace, for example, a 300-lb. melt requires 30 to 32 minutes and a 350-lb. melt takes 35 to 40 minutes.

The average kilowatt-hours per ton on the various alloys runs approximately 950 in the 1,000-lb. furnaces and 850 in the 400-lb. furnaces.

These figures are measured at input to motor and include the power used to hold the temperature constant



Schematic Wiring Diagram of Furnace Circuits

during the pouring period. When high-speed steel ingots are poured some installations have shown as low as 660 kw.-hr. per 2,000 lb.

Metals are usually melted in acid linings which give some 200-odd heats before they are replaced. The four-furnace equipment, of which only one furnace operates at a time, gives excellent means for keeping the production of the shop up to normal. The spare furnace in each size permits repairs to refractories without interruption of the melting schedule.

Description of Equipment

The furnaces are typical Ajax-Northrup coreless induction furnaces and are energized by high-frequency current, which is supplied by a motor-generator set. A synchronous motor rated 250 hp., 2,200 volts, three phase, 60 cycles drives the generator. The generator is single phase and is rated 150 kw. The motor-generator set, together with starting switch, condensers, etc., is housed in a room which is closed off from the foundry proper, but is adjacent and under the same roof. Ventilation is provided to prevent overheating and the room is kept free from dirt and fumes.

The generator control panel, which, together with condenser controls, regulates the furnace production, is mounted in the wall of the generator room. The face of the panel with meters and switches is toward the furnaces and the operator has but a few steps to go from his furnace to the controls.

The four furnace units, two of them holding 400-lb. charges and two holding 1,000-lb. charges, are mounted in a row about 6 ft. out from the generator room wall. Switches are provided so that any one of the four furnaces can be thrown into service in a few seconds. All four furnaces are of the type which "tilt around the spout" and are tilted by means of an electric hoist, operating on an I-beam over the back of the furnaces but well above them to give ample headroom.

Metal is poured from the furnace into ladles which have been preheated with oil and from the ladles into the molds. When small molds are poured, and the time for pouring off the heat extends over several minutes, a small amount of power is turned on the furnace to maintain a constant temperature.

Table I—Typical Metals Run in the Furnaces

	Cr.	Ni.	Mn.	C.	Si.	
No. 600	18.80	9.0	0.6	0.2	0.42	Heat and corrosion metal
No. 8	25	10	....	1.15	....	Abrasion resistant and hot worked tools
No. 9	18	8	....	0.25	0.5	Corrosion resistant
No. 7	16–20	65–70	....	0.5	....	Heat resisting
No. 11	22	23	....	....	....	Heat resisting
No. 15	28	7	....	....	....	Heat resisting

Table II—Meter Readings During a 1,000-Lb. Melt of 22 Cr., 23 Ni. Steel

Time, in Min.	Gen., Volts	Gen., Amps.	Gen., Kw.
0	900	200	175
5	1,000	182	175
20	1,000	175	175
35	970	185	175
50	900	200	175
65	940	200	175
80	900	200	175
95	900	200	175
110	900	200	175
120		Poured	
Pouring temperature, deg. F.			2,900
Time to melt, hours			2
Kilowatt-hours measured at input to motor			490
Kilowatt-hours per 2,000 lb. =			980

Conclusions

The equipment is now well past the experimental stage and the data given above are typical of the day-in-and-day-out performance. The uniformity of metals cast and their invariable high quality have resulted in increased demand for the product. A considerably larger installation is now being considered.

"Neon-Lighted" Waterfall

THIS 300-ft. watercourse on a 5-acre estate at Beverly Hills, Cal., is lighted a Nile blue by means of 28 special units employing gas-discharge tubes. A double coil lamp concealed in a bird-house lights the upper falls, while the lower falls are illuminated by special units concealed in the rocks or foliage. Current consumption is about 750 watts.

A Compact Switchboard

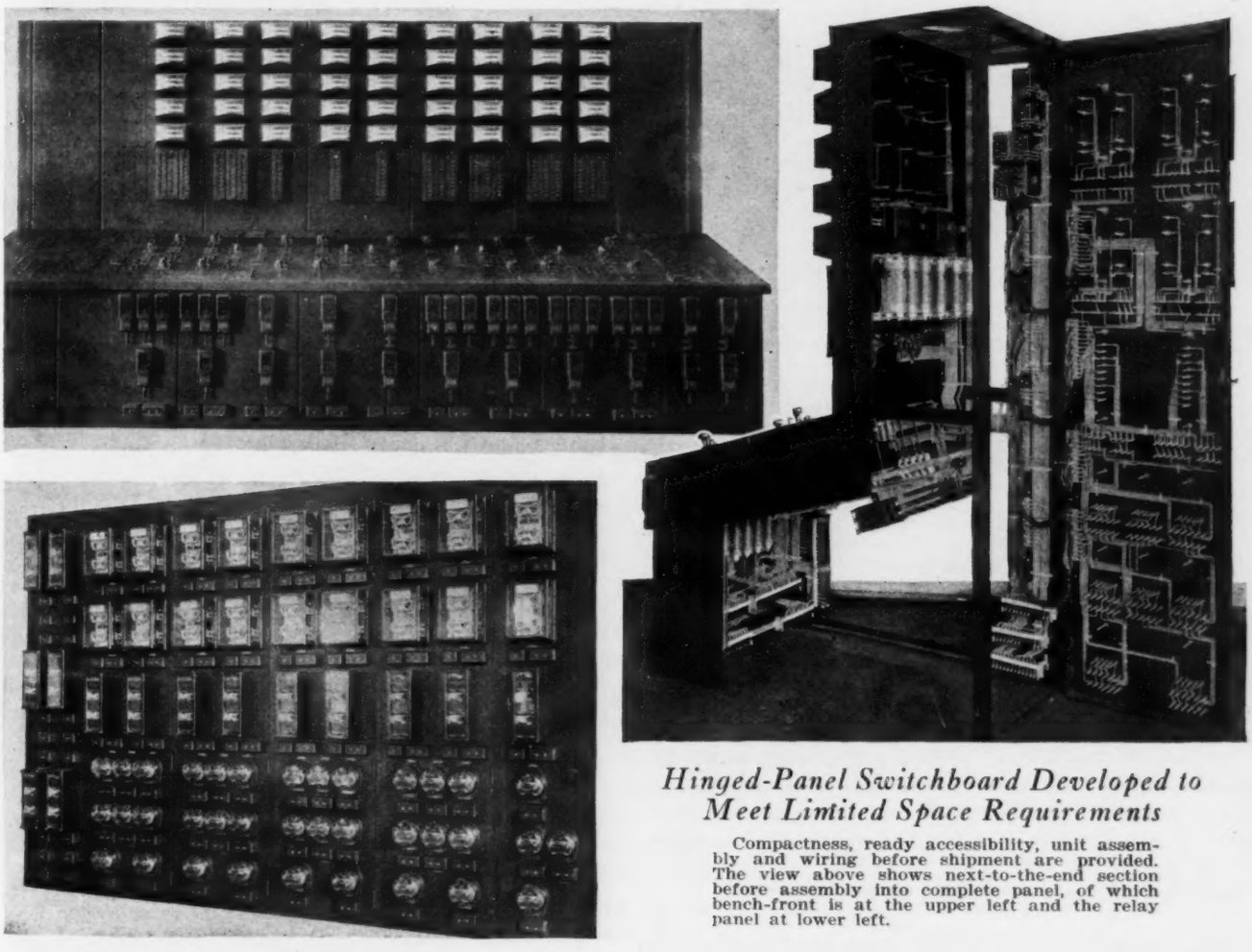
By Emil G. Bern
Switchgear Department, General Electric Company

THE days of switchboards 50 to 100 ft. long for average installations seem to be definitely past. Present demands call for more and more condensed arrangements of instruments, meters, relays, etc., and the panels on which they are mounted. As a result a compact switchboard was developed to meet limited space requirements.

In developing this type of switchboard use was made of standard devices, the principal problem being to arrange connections and mountings in such a manner as to retain the usual safety features and accessibility. The use of metal as panel material facilitated matters by providing a self-supporting structure. Complete equipment for sixteen circuits can be accommodated in the space required by a good-sized office desk. A hinged panel construction gives accessibility while in service. The compact switchboard is factory-built complete.

The hinged-panel principle has brought with it simplicity of maintenance work when any one circuit may require attention. By opening a hinged panel one has access to the entire instrument and control equipment with their connections without the necessity of having a working space inside. This is done with no risk of interference with other equipments or connections. The feature of compactness is one that appeals to the operator as well as to the designer of the power plant. This construction, while built on the unit principle so that additional units may be inserted anywhere in the structure, is wired to terminal blocks near the floor and is shipped completely assembled in unit lengths dependent on local conditions at the point of installation.

A benchboard of the closed type, with hinged rear panels for mounting equipment not concerning the operator, is shown in the accompanying illustration. It illustrates one unit of the bench type construction with the rear door open showing the flexible connections between the door and the stationary structure. It will be seen that this board is completely wired at the factory and is shipped assembled in any length that can be handled by the customer at the point of installation.



Hinged-Panel Switchboard Developed to Meet Limited Space Requirements

Compactness, ready accessibility, unit assembly and wiring before shipment are provided. The view above shows next-to-the-end section before assembly into complete panel, of which bench-front is at the upper left and the relay panel at lower left.

In order to extend the benefits of metal panels to the small purchaser who may have a mixed construction of live-front and dead-front equipment, and also of hand-operated apparatus which requires a good supporting structure, the pipe supported metal switchboard was developed. This was also brought out to meet the demand, by some of the most successful installation men, for a separate structure that could be lined up and plumbed before setting up the completely equipped panels. A finished and attractive end-section with grill inclosure is sometimes used where neatness of appearance is desired.

There is neither necessity nor advantage in using the pipe supports for metal boards with light equipment and where such equipment does not require a frame struc-

ture for mounting. The same advantages in wiring are obtained without the pipe supports and the board is braced in the usual manner to the wall, or is made self-supporting by fastening to the floor.

Salvaging Scrap Cable

SCRAP cable is perhaps the largest and most valuable item of junk handled by public utilities, and as it contains two commodities, copper and lead, for which there is always a ready market, the methods of preparing it for sale should be carefully considered. There are three common methods now in use, points out the purchasing and storeroom committee of the N.E.L.A. in report No. 289-55:

(a) *Sale Based Upon Analysis.*—The metal content may be approximately determined by analysis of samples. This method is fairly satisfactory if each size is weighed and sold separately with sealed ends and joints excluded. The great element of doubt under this method is the proper allowance to make the junk man for his labor in recovering the metals. He may be able to employ cheaper labor but is not in a position to develop machinery and methods as well as a public utility.

(b) *Mechanical Separation.*—The copper and lead may be separated by mechanical means. This may be the crude hammer and knife, the motor-driven rotary knives, which have been in use for several years, or some other mechanical equipment. It is doubtful if satisfactory costs can be effected and a large production handled with the machinery now developed. It must be admitted that the scrap trade prefer copper and lead produced by this method and the development of satisfactory machinery will be followed with great interest.

(c) *Separation by Furnace.*—The reduction of scrap cable to its component metals by means of a furnace is the method used by a great number of utilities. This method has the great advantage of low cost per ton handled and the final elimination of the useless insulation, filler, etc., also a large production can be handled quickly and in a comparatively small space. These advantages more than compensate for the small percentage of metals lost in the burning operation. If the work is properly done the metals will command the highest market prices, and there will be the satisfaction of knowing exactly what is being sold and what it costs to produce it, which is not possible under the analysis method.

The copper from cable will take the highest grading, and if it is desired to bale it this can readily be done on account of the annealing which it has undergone.

The lead from cables always has a wide and ready market, and in many cases a great deal can be used within the company for various purposes. If should be cast in pigs of a convenient size for the trade. One company found a new market for its scrap lead by casting it in small pigs of a size designated by the customer.

The work of salvaging can be done so as to insure that the lead will be free from traces of metals other than those in the original composition of the cable sheath.

It has been found well worth while to separate the seals on the ends of the cables and the soldered ends of the cable joints on account of the tin content. One company makes it a practice to accumulate all the scrapped cable joints and run them in separate lots through their scrap furnace. The lead and solder is run off and the resulting mixture is segregated from the ordinary lead on account of being worth about 50 per cent more. The conductors with their sleeves are pulled out of the fire before they get too hot and the sleeves are melted off by dipping in a pot of hot lead.

Cathode-Ray Oscillograms of 220-Kv. Arresters

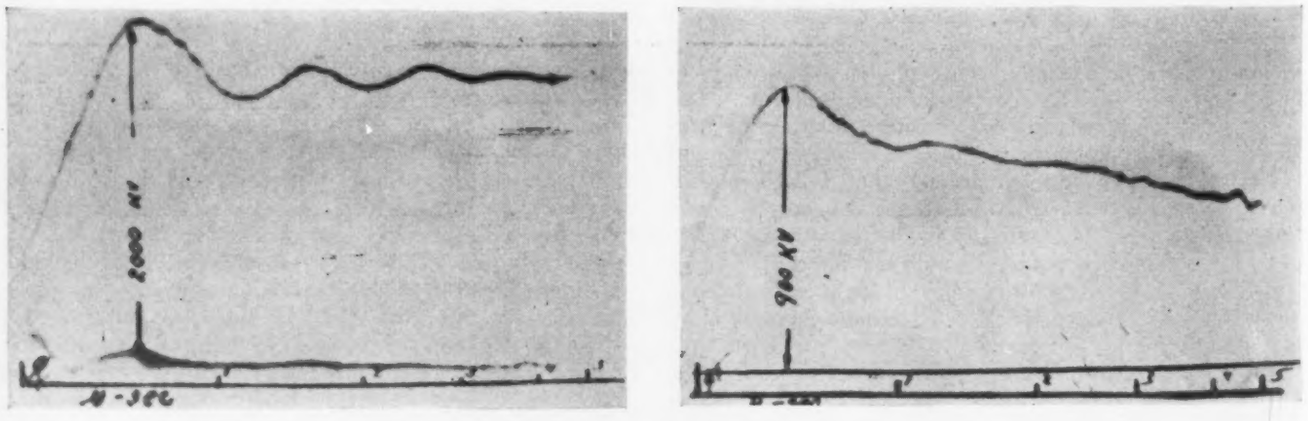
By E. Beck
Supply Engineering Department,
Westinghouse Electric & Manufacturing Company

RECENTLY the cathode-ray oscillograph has been used with generators capable of delivering 1,000,000 volts or more. This has permitted the recording of complete high-voltage arrester performance at the high-voltage laboratory of the Westinghouse Electric & Manufacturing Company at East Pittsburgh.

When a 2,000,000-volt surge was applied to the line and ground terminals of a complete station type autovalve arrester rated at 220 kv. from line to ground the arrester permitted the voltage to rise to 900 kv. only.

Consider a 230-kv. class transformer with graded insulation, suitable for operation on a line insulated, adjacent to the station, by strings of suspension insulators whose 60-cycle dry flashover is 650 kv. r.m.s. or 916 kv. crest. The impulse flashover of these strings varies from about 10 per cent higher than the 60-cycle crest flashover for surges of long duration to more than twice this for steep front waves. The terminal voltage of the arrester is substantially the same whether the transient is steep or slow, hence it is apparent that since the arrester voltage is lower than the flashover of the insulator string, it provides a considerable margin of safety for the apparatus.

The oscillograms here shown are, the author believes, the first of such high laboratory surges and the first of the performance of a complete high-voltage arrester.



Oscillograms of Arresters

At the left is shown a cathode-ray oscillogram of a 2,000,000-volt lightning-generator surge. The other record indicates the voltage across-the-line and ground terminals of a 220-kv. autovalve arrester. Note that the voltage rise did not exceed 900 kv.

The Job Ahead*

Adequate wiring, more appliances and increased use of electrical energy must be sold. Mergers enable rate reductions and promotional rates encourage sales efforts

By M. S. Sloan
President National Electric Light Association

RECENTLY a survey was made to ascertain electric conditions in the home. It was comprehensive enough in character to reflect the state of affairs throughout the country. Among the results of that survey were these, which seem to be especially significant:

A large majority of the homes were found to be inadequately wired, especially as to convenience outlets.

Only four appliances were found to be in general use, the flat iron, the portable lamp, the vacuum cleaner and the toaster.

Housewives were found to be unawakened to the idea of the completely electrified home.

Yet about half the women who were interviewed in the course of this survey said they wanted to do more of their work electrically.

That survey showed that the American home was potentially a great market for wiring, for appliances and for the increased use of current. It showed little evidence that the industry had comprehensively sold to the public the idea of using electricity in the home for all possible purposes. It showed that the appliances most extensively advertised and aggressively sold had the widest distribution. It showed, by the number of unused appliances found, that there has been inadequate education in efficient use and care of electrical aids in home-making.

Now, perhaps, there is little in that not already known to all of us in general terms. Here, however, we have it presented to us pointedly. What are we going to do about it? It seems to me there can be only one answer in accord with the spirit and record of the power and light industry. We're going out to sell more wiring, more electrical appliances, more current in the home. We're going to sell the idea of the completely electrified home. We're going, wherever it is necessary, to educate housewives in the proper use and care of appliances so that they will be kept in use, not stuck away in the closet. We're going to advertise more extensively and build up better sales forces. Most important of all, we're going to recognize this effort for what it must be, not a campaign, but a long-distance enterprise entered upon with the determination each year to better the preceding year's results. I say we are going to do all this. I believe, I know, we are going to do it because we have no choice in the matter. We must do it. First, we must do it as a matter of business. Our companies, as a group, are prosperous today, as they deserve to be, but there is not one among them which can afford to stand still. There is not one which has not the necessity of increasing sales, especially of increasing the sales of current for domestic use.

More energy is not used in the home because of inadequate wiring and insufficient convenience outlets, because only the iron, toaster, cleaner and portable lamp are in general use, and because housewives have not been awakened to the idea of a completely electrified home, although they want to do more work by electricity.

These conditions must be corrected, and besides, appliances must not be allowed to fall into disuse, better sales forces must be developed, inducement rates must be introduced, and a long-time sales effort embarked upon.

Mergers and consolidations will help reduce rates, but the public must be convinced by practice that benefits will be shared with them.

One very important part of our sales effort, I believe, will be the form of rate schedules in effect. We must literally make it cheaper to use electricity than not to use it. We must get the price of electricity in the quantity necessary for a thoroughly equipped electrical home down to a figure which would make the housewife see how uneconomical it would be to spend her time and strength on tasks which electricity could do better, quicker and at such small cost. Our industry has already gone far in bringing down domestic rates, and many companies have adopted rate schedules specifically intended to promote large use of service by lowering the price as the quantity used increases. The success of such selling of service,

**Excerpts from address before New England division of N.E.L.A. at New London, Conn.*

both from the point of view of the customer and of the company, commends it to the serious consideration of all companies which have not adopted it.

Lowered prices, however, are not possible without lowered costs, and when they are put into effect there must be reasonable probability that a quickly increasing volume of sales will result from them. One means of obtaining lowered costs—mergers of operating companies and extension of holding company participation in utility development—has recently aroused critical comment.

Mergers Enable Rate Reductions

Some people profess not to believe that mergers and holding company combinations in the utility field are actually being brought about as an economic necessity in order to provide better and cheaper service. Some people are apprehensive lest such combinations, particularly of holding companies, may become a menace to the public interest through their size and financial power. Both these contentions, it is obvious to us, are based on misunderstanding of the economics of our business and the nature of holding companies and their part in the utility industry.

We have it in our own hands, however, to help clear away such misunderstanding. Even more, we can nullify the present criticism and disprove its allegations and suspicion by our own policies and practices. If public utilities obtain advantages and benefits from these mergers and consolidations and groupings of companies which result in profits, those profits should be split with the customer in lowered rates. There is nothing revolutionary about that. It has been done. I believe it is being done wherever possible, as the lowering price of current over the years shows. Our industry has a splendid record in this respect. It should be, however, a recognized policy and practice of the industry, so there would remain in the public mind no question that the customers will benefit as the companies benefit.

The further development and future progress of utilities are directly concerned in this situation. Holding companies have played an important part in bringing many power and light companies to their existing state of development by aid in financing, engineering, marketing, administration. Their part in utility development will not lessen in importance, but in all probability will increase.

The Way to Prove Value of Mergers

For our own business welfare, and as a duty we owe, because we are public service organizations, it is necessary that we take such steps as are possible to improve our service, reduce our expenses, increase our sales. When mergers of operating companies help bring these things to pass, it is in the public's interest equally with our interest. When holding company management or control will enable the public utility to better its service, increase its sales and put it in the way to lower its rates, that too is in the public interest as well as in the interest of the companies in point. And when these events take place it remains for us to prove by our deeds that benefits to the customers will accompany benefits to the companies.

Doing this, we shall be in a position, with the public's confidence, to carry on such necessary operations. We shall be able to set up conditions which will allow us to go after the domestic business we don't get now by way of rates which will truly make it cheaper to work with electricity than without it.

The usefulness of our companies must be increased year by year if we are adequate to our job. They must do their part in electrifying the American home as they have electrified the American factory, so that the American woman may not have to toil as her husband, working under modern conditions, would refuse to do. Our companies must bring America to the point so glowingly predicted by Mr. Ford, and nobody knows better than we that that is our ambition and our ideal.

The fact that there are difficulties to be encountered need not daunt us. Our companies have certainly overcome major difficulties in other phases of our business, presenting problems as trying as any involved in the sales effort necessary to electrify the home.

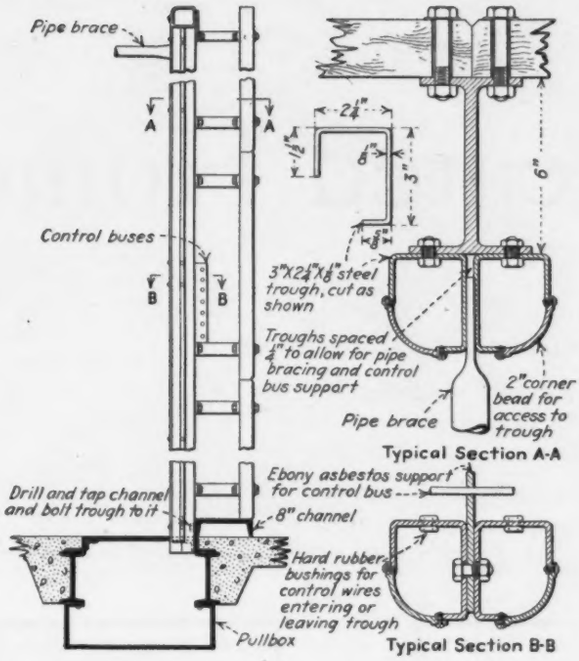
What we need at this stage of events, as they appear to me, is a clear comprehension of the elements in the situation—the essential part promotional rate schedules will play in our sales effort and the lack of public comprehension of one of the chief means by which our industry is moving to make possible the selling of more electricity for less money. Then we need the determination to solve the problems so presented to us. The outcome cannot be in doubt, and our companies will follow their natural line of economic progress which will be justified by its results. We shall be doing our job in the only way in which it could and should be done, with mutual benefit to the public we serve and to ourselves as a business worthy of the public's hire.

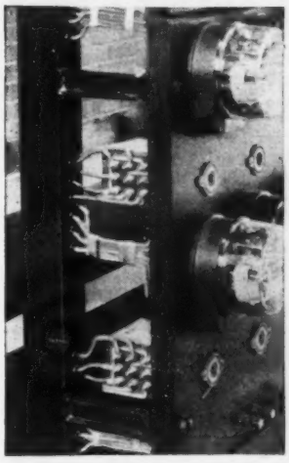
Control Wiring Concealed in Panel Supports

A COMBINED wiring trough and panel support for simplifying and facilitating the wiring of switchboards, permitting neat appearance with accessibility, has been developed by the Scranton Electric Company. Paul Stuckart, chief electrician for that organization, describes the installation as follows:

The control and instrument cables are run through a pull box, or common duct, which can be mounted either above or below the floor at the base of the switchboard extending the full length of the board. Individual cables are brought up from this pull box into a vertical trough which also supports the panel on which the cable terminates. The cables leave the vertical trough at the most favorable points, each individual conductor being brought out separately through a hard rubber socket bushing and run to a terminal block, which may be mounted on the panel at a convenient location adjacent to the instrument or apparatus which it serves, thereby eliminating crowded and intricate groups of back panel wiring. In many cases where the conductors can be terminated to advantage directly on instrument terminal studs, terminal blocks are not necessary.

The wiring of a board or tracing of back panel wiring, according to this method, is very much simplified, especially where a color scheme is used on control and instrument cables, in that the various colored conductors comprising the cable are extended in cable form to the point where they leave the trough. From this point they extend across the panel in a group or separately and are readily traced and identified by their color. In case alterations or additions to the wiring are necessary they can be very easily accomplished without disturbing





Appearance of Panel Wiring Improved Without Impairing Accessibility

the unaffected wiring. Potential and control buses are made up of insulated round copper rods supported on micarta plates.

The trough panel support can be made up in any shop equipped with suitable bending apparatus. The corner bead or cover is a stock proposition and does not have to be made up specially.

Heavy Range Loads Force Closer Transformer Spacing

SINCE 1921 the number of electric ranges on the Toronto Hydro-Electric System has increased from 761 to more than 18,000 and the range load is the peak determinant. Tests reported by G. L. Lillie of the distribution department in *Electrical News and Engineering* show resulting possible maximum demands of from 91 to 360 kw. The latter figure can well double ultimately because it was recorded on a street vacant on one side. The active side is occupied by duplex semi-detached structures in which the ranges are supplied by the landlord. An over-all test for one district containing 37 customers, whose energy-using equipment included 27 ranges concentrated in a stretch of 500 ft., showed a 6 p.m. and noon peak of 52 kw.

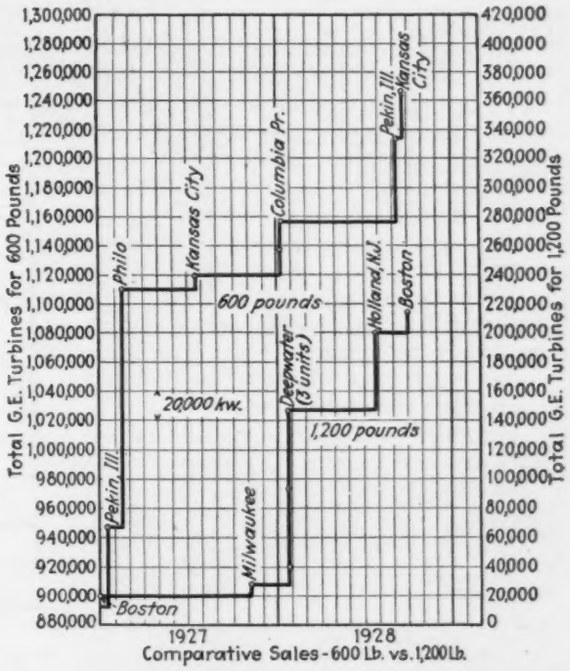
Analysis of the most economical spacing of transformers and size of transformers and of secondaries shows that it is often more economical as the load densities increase to decrease the spacing and increase the size of transformers. It is usually more economical to run services from one-side secondaries than to install secondaries on both sides of the street. With blocks 800 ft. long it proves more economical to extend the primaries into the cross street to the middle of the block than to increase the secondary size.

High Pressure Gaining

THE year 1928 has seen a remarkable increase in the use of higher steam pressures. This increase is shown graphically for both 600 lb. and 1,200 lb. In the last two years about the same capacity of turbines has been ordered for each pressure, with the difference that the use of 600 lb. has been decreasing, while the use of 1,200 lb. has been increasing rapidly.

The General Electric Company has now installed, or on order, nineteen units for 600 lb. and nine units for 1,200 lb., or a total of about 1,250,000 kw. in 600-lb. units and 250,000 kw. in 1,200-lb. units for electric light and power company stations.

A steam pressure of 1,200 lb. for the turbines is working out so satisfactorily in the Edgar station at Boston that a third 1,200-lb. turbine is to be added.



Comparative Sales of 600- and 1,200-Lb. Steam Turbine Units

In order to obtain improved economy at light loads and better over-all station efficiency a 12,500-kw. turbine with multi-valve admission was selected rather than a duplicate of the recent single-valve 10,000-kw., which, together with a 3,000-kw. unit, is now operating in this station.

Two Years with
Electrically Heated Home

Use of fin type air heaters with demand control switch gives satisfactory results. Data on operation over a two-year period

By C. P. YODER
Sales Manager Erie County Electric Company, Erie, Pa.

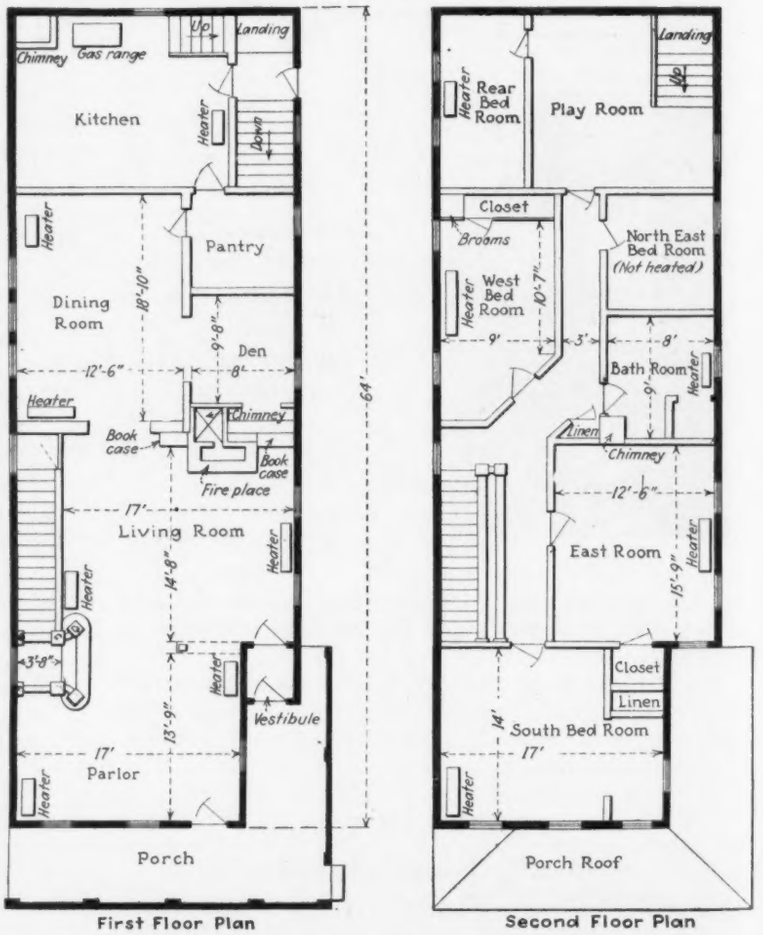
THE fact that electricity has been the means of solving a great many industrial heating problems has no doubt, in part, stimulated man's desire to utilize it in the heating of buildings, particularly the home.

A number of articles have recently appeared in the technical press describing various systems of electric heating, all of which have merit but at the same time present difficulties that seem to preclude their general acceptance.

The heating system described in this article has been in use in the home of J. E. Gannon, Erie, Pa., during two heating seasons. Several novel features of design and operation produce economy and convenience of operation which make it of interest to the home owner, and to the central station as a desirable load for increasing domestic consumption of electric energy.

The house is an ordinary frame building, rather unsuited to the refinements of electric heating due to the fact that it was built some 50 or more years ago, when the idea of heat insulation was practically unknown.

The general design of the building and the first and second floor plans are shown in the accompanying illustrations. The first floor interior consists principally of three large adjoining rooms having large connecting openings that cannot be closed and exterior walls on practically all sides. The pantry and kitchen are the only rooms that can be isolated from the remainder of the first floor. The ceiling height of these rooms is 10 ft.



Floor Plan of Electrically Heated Home Showing Location of Heaters

Access to the second floor is gained by means of a wide, open stairway leading from the parlor to the large central hall above, from which the bathroom and various sleeping rooms open. The stairway and hall present somewhat of a heating problem. Four bedrooms and bath are regularly heated. The ceilings of these rooms are 9 ft. high.

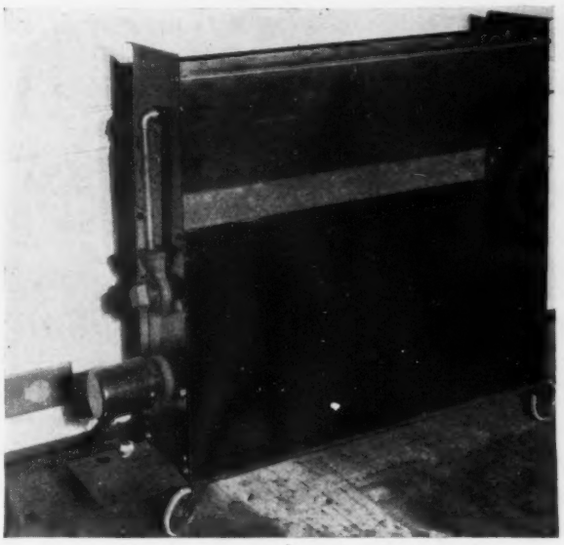
The outside of the house is covered with ordinary 6-in. siding, attached directly to the 2x4 studding, without building paper. The sheeting is fastened to the inside of the studding under the lath and plaster and extends only between floor and ceiling of each floor. There was, thus, an area the width of the second floor joists extending completely around the house having only the siding as protection from winds and drafts.

After the electric heating system had been in operation for about a month the need for effective insulation was apparent. This was accomplished by first removing the

Two Views of Erie, Pa., Home Heated by Electricity

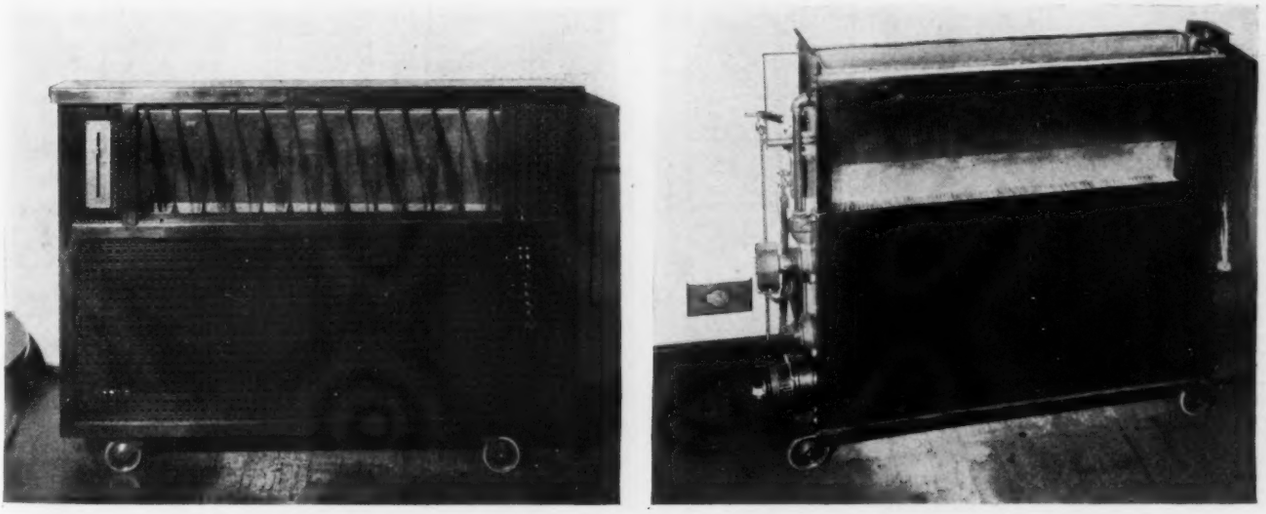
siding in the vicinity of the second floor joists and closing the openings between the studding with beaverboard, after which the spaces between the sheeting and siding from sills to roof were filled with granulated cork. A layer of this material about 4 in. deep was also placed in the attic between the joists. To accomplish this insulation required about $2\frac{1}{2}$ tons of granulated cork. The material and labor of installing cost approximately $175. As a further protection, all of the windows and outside doors were equipped with metal weather strips.

Previous to the installation of the electric heating system a vapor system was in use. This consisted of a D-1500-S "Ideal" gas boiler, 1,500 sq.ft. capacity and 435 sq.ft. of heating radiation distributed between twelve cast-iron radiators. Six of these, with a total of 258 sq. ft. of radiation, were located on the first floor and the remainder, 177 sq.ft. of radiation, were on the second floor.

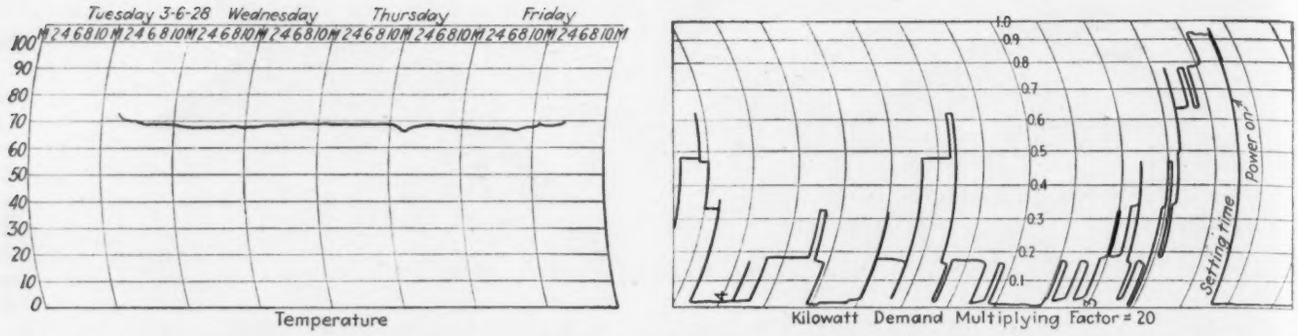


Auxiliary Heater Unit

The electric heating system consists of twelve fin type convection air heaters rated 3 kw., 220 volts, each, or a total connected load of 36 kw. The effective radiation per heater is 60 sq.ft., giving a total radiation for complete electric heating installations of 720 sq.ft.



Appearance of the 3-Kw. Radiant Heater With and Without Cover



Typical Mean Room Temperature Chart and Instantaneous Demand Chart During Test

In appearance, the units suggest the conventional radiator and art metal cover except that in the present installation the units are provided with castors to facilitate their movement for cleaning or summer storage. Electrical connections are made by means of flexible cord and mogul attachments. By altering the design and finish of the metal covers, the units may be made to harmonize with their surroundings.

Immersion Heaters Warm Radiators

The main features of the heater are disclosed by removing the metal cover. These consist of two horizontal copper tubes, one above the other, the ends of which are expanded into cast-iron fittings provided with suitable openings for heating units, thermostats, etc. Copper fins and spacers are pressed on the tubes before assembly to serve as radiators. A water pan, located above the radiator proper, is connected to the latter by two $\frac{1}{4}$-in. tubes. One of these extends from the bottom of the pan to the cast-iron fitting, through which water is supplied to the heating chamber of the unit; the second serves as an air vent. The heater, thus assembled, is inclosed by a metal jacket open at bottom and top to direct the flow of heated air.

A 3,000-watt, 220-volt standard immersion heating unit is installed in the lower tube through a threaded opening in the cast-iron fitting. A thermostat for regulating the water temperature is similarly installed in the upper tube. Thermostat adjustments are made to close the electric circuit when the water temperature drops to 190 deg. F. and to open it when the water temperature reaches 205 deg. F. The heating chamber holds about $2\frac{1}{2}$ qt. of water and the pan about 5 quarts.

The water pan serves a threefold purpose: (1) It provides access to the heating chamber; (2) it serves as an expansion tank and reserve reservoir; (3) it acts

Table I—Daily Operating Data During First Heating Season

Date	Daily Consumption, Kilowatt-Hours	Outside Temperature, High	Outside Temperature, Low	Average Hour Wind Velocity	Hours of Sunshine
January 7, 1928	0	43	39	19.0	1.7
January 8	70	40	34	7.2	0.0
January 9	70	37	32	10.1	0.0
January 10	60	42	33	19.9	1.7
January 11	90	45	34	17.4	0.0
January 12	90	49	34	18.1	0.9
January 13	110	48	35	20.1	0.9
January 14	110	59	35	17.5	0.4
January 15	70	54	24	13.1	0.1
January 16	150	46	21	9.8	0.0
January 17	140	33	30	16.2	2.9
January 18	110	36	31	10.0	4.6
January 19	110	50	36	27.8	0.0
January 20	135	38	12	35.9	0.6
January 21	260	19	11	25.5	0.6
January 22	195	36	14	23.3	9.0
January 23	120	35	30	17.7	5.7
January 24	110	40	30	19.6	0.0
January 25	160	34	20	31.0	3.1
January 26	190	26	14	17.7	2.4
January 27	200	24	12	8.1	7.9
January 28	160	16	10	13.0	2.3
January 29	180	18	8	9.7	5.6
January 30	160	19	2	7.8	7.0
January 31	130	26	13	9.6	5.2
February 1, 1928	150	29	18	20.7	0.3
February 2	170	24	16	12.6	4.2
February 3	150	45	22	17.2	1.5
February 4	60	48	32	16.3	0.1
February 5	60	32	17	18.4	10.2
February 6	130	32	14	8.6	10.2
February 7	70	46	29	18.3	0.0
February 8	40	53	36	12.7	0.0
February 9	20	37	25	16.8	0.0
February 10	60	30	24	11.5	1.7
February 11	50	31	28	9.1	2.8
February 12	60	29	20	6.8	10.5
February 13	70	48	19	12.5	10.5
February 14	45	42	37	22.8	1.6
February 15	45	38	32	19.8	0.0
February 16	60	34	30	11.3	0.0
February 17	55	37	27	9.1	8.1
February 18	60	32	12	14.4	6.7
February 19	115	28	7	21.0	7.9
February 20	100	28	9	20.5	7.3
February 21	110	20	7	13.1	10.8
February 22	120	45	16	21.2	5.3
February 23	75	45	24	16.9	0.9
February 24	70	24	12	16.1	0.3
February 25	125	14	6	6.3	2.4
February 26	140	24	3	17.4	7.5
February 27	100	34	24	16.6	5.9
February 28	70	39	16	9.5	8.4
February 29	45	39	31	19.7	4.0
March 1, 1928	65	32	21	17.5	8.5
March 2	90	36	22	18.9	5.2
March 3	80	23	13	14.3	8.3
March 4	90	42	20	21.8	5.1
March 5	100	20	12	11.2	6.3
March 6	100	28	13	6.7	11.5
March 7	90	38	24	16.8	3.5
March 8	75	31	19	7.3	10.7
March 9	65	38	20	18.0	0.0
March 10	90	26	19	5.8	4.8
March 11	100	50	23	11.0	11.7
March 12	55	55	36	7.3	10.2
March 13	15	65	36	21.3	5.2
March 14	20	36	32	19.1	0.2
March 15	50	32	28	12.8	7.7
March 16	50	28	24	11.6	7.3
March 17	80	30	22	9.9	8.5
March 18	70	28	24	13.2	6.6
March 19	90	30	24	13.0	8.6
March 20	70	32	24	10.8	10.2
March 21	90	42	27	13.2	12.2
March 22	50	45	33	19.1	2.3
March 23	50	56	33	7.0	10.2
March 24	30	75	56	19.4	12.3
March 25	0	60	53	9.2	5.4
March 26	0	71	36	17.6	10.1
March 27	20	38	23	25.0	10.1
March 28	70	35	26	13.6	10.9
March 29	60	34	26	13.4	7.2
March 30	80	36	23	18.0	0.4
March 31	90	36	26	15.3	12.7
April 1, 1928	70	43	31	5.9	12.7
April 2	40	58	30	10.8	12.8
April 3	30	68	49	22.5	8.7
April 4	0	77	57	16.9	11.4
April 5	0	78	61	16.0	10.6
April 6	0	79	59	16.3	11.4

Total number of days	90
Total kilowatt-hours consumed	7,730
Average kilowatt-hours per day	85.9
Total number of degree days	3,013
Average kilowatt-hours per degree day	2.56

as an air humidifier. By means of slides in the cover of the pan the amount of escaping water vapor may be controlled.

A second thermostat, installed below the lower radiating fins, near the floor and in the path of the incoming air, controls the room temperature. The location of this thermostat at the point of coldest air temperature prevents its functioning until the entire room is at the proper temperature. The desired temperature setting is obtained by means of a lever projecting through a slot in the front of the cover. Adjustments may be made for room temperatures between 40 deg. and 80 deg. F.

The foregoing heater is called the controlling or master heater. Six of these are used in the installation being described. In addition, there are six auxiliary heaters. The latter are similar to the master heaters with the exception of the omission of thermostats. Each auxiliary heater is operated in conjunction with a master heater, by having its heating unit connected in multiple with that of the master heater. When the latter functions the auxiliary heater responds in a similar manner.

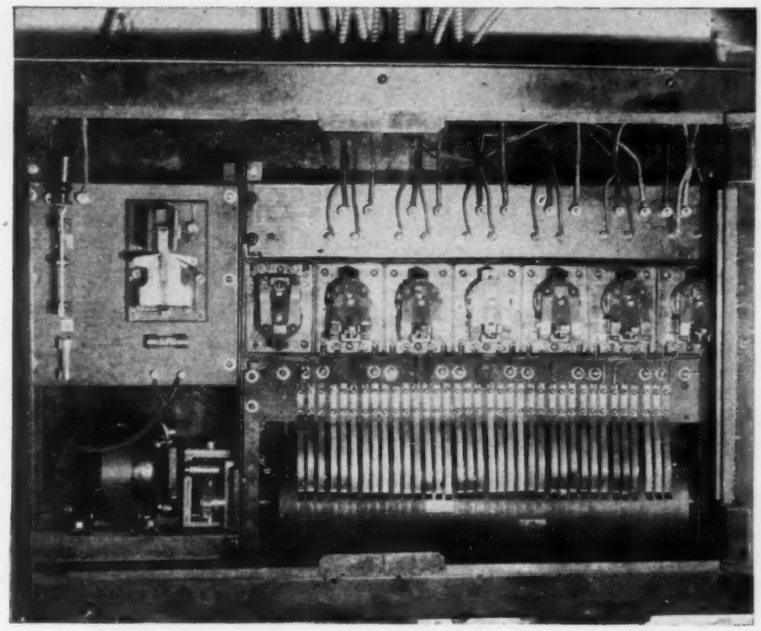
Since the total installation includes twelve heaters of 3 kw. capacity each, the system demand, if all the heaters were operating at the same time, would be 36 kw. To control the demand to a predetermined amount, an ingenious device known as a selector switch or kilowatt demand controller has been developed.

During the first heating season—that is, from January 7, 1928, when the installation was first put in operation, until April 6, 1928—nine heaters were in use, having a total connected load of 27 kw. At this time the selector switch had not been developed. Each heater acted independently and cut in or out in accordance with the temperature conditions of the room in which it was installed. Later development of the selector switch offered improved control.

In Table I are given data of daily power consumption, maximum and minimum outside temperatures, average hourly wind velocities and hours of sunshine during this period. On February 3, 1928, the addition of cork insulation, as explained above, was completed. It is interesting to note the effect this had on the consumption of energy, Table IV. For the first 27 days the average daily power consumption was 135.1 kw.-hr. During a corresponding period immediately following February 3 the average daily consumption was 75 kw.-hr., or a reduction of 44.5 per cent. This is directly due to the addition of the insulation and is a measure of its effectiveness.

During the first heating season no heat was supplied to the kitchen and pantry on the first floor or the playroom and storage room on the second floor by the electric heating system. These rooms were heated by means of the kitchen range.

The first floor temperature was maintained at 70 deg. F. throughout the 24 hours, with a variation of not over ± 0.5 deg. This was the temperature about 5 ft. above the floor. Numerous tests indicated that the maximum variation between floor and ceiling was never more than 4 deg. This is a rather unusual condition and demonstrates the effectiveness of the heaters in producing rapid circulation. Because of the habits of the family, the sleeping rooms were maintained at about



Selector Switch for Automatic Heater Control

The selector switch consists of a motor-operated selector drum and eight relays. Seven of the latter are of the two-circuit type, having opening and closing coils. Six of these are connected to the control circuits of the master heaters; the seventh is in one of the lines of the motor circuit. The eighth relay, in the other line of the motor circuit, is of the single-circuit type. The relay circuits terminate in the contact fingers on the selector drum. By means of contact bars on the latter various electrical combinations may be obtained. The whole assembly is housed in an approved metal box provided with double doors and means for locking.

In operation, the selector switch functions as follows: If all of the rooms are at the desired temperature the single-circuit relay will be open and the two-circuit relay in the motor circuit will be closed. All of the heater relays will be open and the selector drum contact fingers may be in any position, for example, connected to circuit No. 3.

Now if the temperature in the room controlled by circuit No. 1 drops below normal, the air thermostat of this heater will close the single-circuit relay in the motor circuit, causing the motor to rotate. Assuming that the temperatures of the rooms controlled by circuits Nos. 4, 5 and 6 are normal the drum will be rotated past these points. When the No. 1. position is reached the relay in this circuit is closed through the contact fingers and a contact bar on the drum. Another contact finger connecting with the same bar opens the two-circuit motor relay. After the motor circuit is opened the motor coasts sufficiently to break the circuit through the bar and the contact fingers.

Closing the heater relay connects the electrical element of the heater to the line and supplies energy to the water. This condition will exist until the water has reached the temperature determined by the setting of the water thermostat, 205 deg. F., when the latter functions to open the No. 1 relay and at the same time close the two-circuit relay in the motor circuit, which causes the motor to resume its rotation.

If, in the meantime, the temperature controlled by circuit No. 2 has dropped below normal, rotation of the selector drum to position No. 2 will cause this relay to close, connecting No. 2 heater to the line and at the same time stopping the motor until the proper water temperature in No. 2 heater is obtained.

If, on the contrary, No. 2 heater is up to normal but one of the other heaters requires energy, the selector drum will advance to the contacts corresponding to the low heater.

When the air temperature in all of the rooms is normal, the air thermostats of all the heaters will be open, thus breaking the motor circuit by means of the single-circuit relay and bringing the motor to rest.

Since only the load controlled by one relay can be connected to the line at one time, the system demand is determined by the number of heaters connected to one circuit. In the present installation there are two heaters, or a total of 6 kw. connected to each circuit. In other installations this number may be one or possibly three, depending upon the size of the house to be heated.

As now installed, each master heater is connected to the selector switch by means of No. 10-2 wire B.X. cable for the heating circuit and No. 16-2 wire B.X. cable for the control circuit. Simplified plans are being developed whereby the six relays in the heater circuits will be eliminated by including their functions in the selector drum. This will permit the use of No. 12-3 wire B.X. cable for connections to the heaters, as well as greatly simplifying the selector switch.

Table II—Operating Data During Second Heating Season

Month	Kilowatt-Hours	Average Daily Temperature, Degree Fahr.	Degree Days
October, 1928	520	56.6	260
November, 1928		44.4	618
December, 1928	2,595	35.4	918
January, 1929	3,364	25.3	1,231
February, 1929	3,787	24.8	1,126
March, 1929	2,315	42.2	707
April, 1929	1,570	48.6	492
Total	14,151		5,352
Average kilowatt-hours per degree day		2.64	
Total number of days		212	
Average kilowatt-hours per day		66.7	

63 deg. F. during the daytime and cooler at night. No radiation was installed in the upper hall, but, due to its direct connection with the first floor, it received plenty of heat from the latter; in fact, the upper hall temperature was usually in the vicinity of 80 deg. No effort was made to heat the basement. The temperature here was usually about 55 deg. F. when the outside temperature was 30 deg. The relative humidity of the living rooms was maintained between 45 and 50 per cent.

In spite of the absence of the selector switch during the first heating season the system demand never exceeded 9 kw. To test the joint operation of the heaters the power was shut off for three hours when the outside temperature was about 26 deg. F. The inside mean temperature fell from 70 deg. to 66 deg. during this interval. When the power was again thrown on the instantaneous peak was 18.5 kw., but the fifteen-minute metered demand was only 7.6 kw. About three minutes after power was applied one heater tripped off; four minutes later another unit tripped off, and a few seconds later another one came on, etc., in accordance with the heat requirements of the various rooms.

The results of this test are shown in the accompanying charts, which indicate respectively the mean room temperature and the instantaneous system demand. The temperature chart shows the dip in temperature due to shutting off the power as well as the normal regularity in temperature throughout the 24 hours.

The total power consumption during the first heating season of 90 days was 7,730 kw.-hr., or an average of 85.9 kw.-hr. per day. This, of course, includes the 27 days when the house was not insulated. Eliminating the uninsulated period, the average daily power consumption for the remainder of the season was 64.8 kw.-hr.

The information gained during the first heating season suggested various changes and improvements, chief of which were the development of the selector switch and the addition of three heaters. These improvements produced the system described in this article.

Table II gives the monthly power consumption for the second season, together with the average monthly outside temperatures and the degree days per month. The average daily consumption of 66.7 kw.-hr. for the 212 days of this season compares favorably with the corresponding figure for the first season after the house was insulated, in spite of the addition of the three heaters.

General Comments

The family occupying this home consists of eight people, of whom six are children, from which it may be inferred that the outside doors were opened many times during the day. It was particularly noticeable that the family experienced no colds during the two years that the electric heating system has been installed. This may be due to the nice balance between temperature and relative humidity and the fact that no drafts were encountered.

Temperature, humidity and air motion are three factors that determine a person's feeling of warmth. These are easily correlated in the present installation and, together with the automatic features which permit each room to be controlled independently of the others, insure a heating system which should meet the requirements of the most exacting individual.

Once installed, the system requires little attention with the exception of addition of water about once a week to the storage pan of each heater. The main circuit switch may be left closed continuously, with the assurance that the automatic features will provide uniform temperature under the most economic conditions. Those cold and damp days in late spring and early fall, as well as sometimes during the summer, may no longer be a source of inconvenience in a home equipped with this heating system. When such periods occur the automatic control will insure the proper heat to maintain normal temperatures within the living quarters.

While no accurate figures are available, it is estimated that this type of heating system will cost approximately the same as an equivalent steam heating system equipped with automatic control.

From the central-station standpoint this load has numerous attractive features. The relatively low demand, together with the high-load factor, permits of a minimum investment in line capacity, while the annual consumption of from 15,000 to 20,000 kw.-hr. per domestic customer should suggest the establishment of promotional rates to encourage the development of this type of load.

Table III—Physical Features of Rooms

Room	Floor	Dimensions Feet	Dimensions Cu.Ft.	Exposed Wall Surface	Exposed Wall Square Feet	Glass Surface	Glass Square Feet
Parlor	First	14x17x10	2,380	14x10x2 17x10x1	450	2.5x6x3 3x9	72
Living	First	21x15x10	3,150	18x10 9x10	270	2.5x6x3	45
Dining	First	19.5x12.5x10	2437.5	19.5x10	195	2.5x6x2 3x3	39
Den	First	8.5x11x10	935	11x10	110	2.5x6x1	15
Hall	First	17x8x9	1,683	17x9	153	2.5x6x1	15
	Second	17x3x9					
East bedroom	Second	12.5x15x9	1,687.5	18x9	162	2.5x6x3	45
Front bedroom	Second	15x14x9	1,890	14x9x2	252	2.5x6x4	60
West bedroom	Second	15x9x9	1,215	15x9	135	2.5x6x2	30
Bath	Second	8x9x9	648	9x9	81	2x3	6
Totals	.....	.....	16,026	.....	1,808	.....	327

Table IV—Effect of House Insulation on Power Consumption

Twenty-seven Days Before Insulation	
Total kilowatt-hour consumption	3,650
Number of degree days	950
Average kilowatt-hours per day	135.1
Average kilowatt-hours per degree day	3.84
Twenty-seven Days After Insulation	
Total kilowatt-hour consumption	2,020
Number of degree days	994
Average kilowatt-hours per day	75
Average kilowatt-hours per degree day	2.04
Reduction in daily power consumption due to insulation, per cent	44.5

Current-Carrying Capacity of Busbars

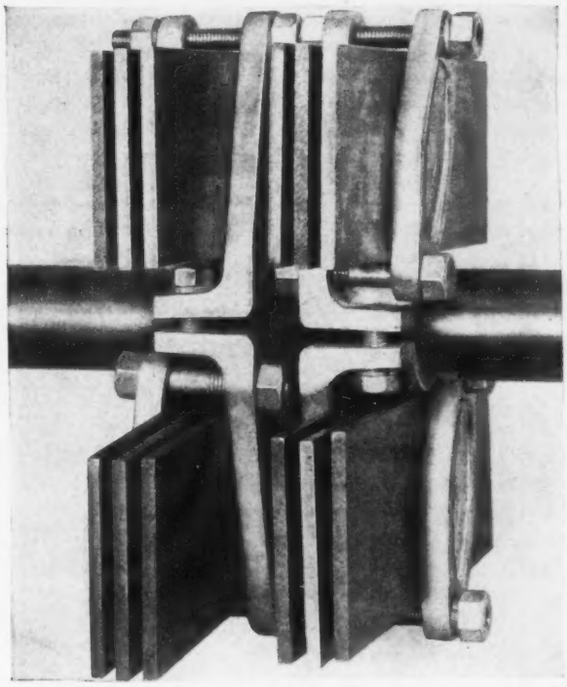


Fig. 1—Modified Hollow Square Bus Minimizes Skin Effect and Promotes Ventilation

Heavy current limits of various arrangements of copper and aluminum bars at fixed temperature rise

By H. W. PAPST

Switchboard Engineering Department
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THE general formula, "1,000 amp. per square inch of copper conductor," though often used, is not satisfactory to fix the size of busbars where currents exceed 2,000 amp. Even for 2,000 amp. a given conductor of 2 sq.in. cross-section may get hot. Furthermore, depending upon the allowable temperature rise, greater densities than 1,000 amp. per square inch may be used.

With alternating currents it has been found that certain magnetic forces have a tendency toward crowding all the current into the outer layer or skin of the conductor. This is commonly known as "skin effect." If the go and return conductors of a circuit are close together another magnetic force is set up between the two conductors which tends to draw the current to the adjacent sides of the two conductors. This is known as "proximity effect." On account of the skin effect in alternating-current conductors an early expedient was to eliminate the useless core of a conductor by using copper tubing.

"Permissible temperature rise" is the limiting factor on busbar current-carrying capacities. With all parts of a bus operating at the same temperature maximum conductor efficiency is obtained. Hot spots lower this efficiency and the maximum current must be such that the temperature limit is not exceeded at the hot spots. The rate of cooling must be as great as possible and, on this account, laminated or strap conductors have an advantage over round conductors.

The current-carrying capacity of laminated buses of up to twelve 3x$\frac{1}{8}$-in. copper conductors in parallel is shown in Fig. 2. An examination of this curve shows a current-carrying capacity of 600 amp. for a single lamination, and yet for the same temperature limit the capacity of twelve bars is only 2,900 amp., an average of 242 amp. per lamination. Increasing the number of bars from ten to twelve increased the capacity of the bus 150 amp., an average of 75 amp. per bar. The twelve-bar laminated conductor and a 4-in. extra-heavy iron-pipe-sized copper tubing have approximately the same volume of copper; the copper in the tubing is better distributed from the skin effect standpoint, and that in the laminated bus is poorly distributed, but has 4$\frac{1}{2}$ times the cooling surface. Both have the same current capacity. A rearrangement of the copper in either conductor changes the current capacity for the same amount of material employed.

Remembering the early experience with rod conductors, and that an increase in copper efficiency was obtained by using tubing, an arrangement of strap conductors was devised, grouping them into a "modified hollow square" to approximate the tubular arrangement and still maintain the advantages of the laminated bus. All

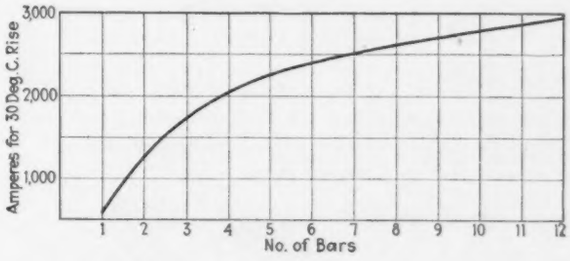


Fig. 2—Current Capacity Not Increased Proportionately to Number of Bars in Parallel

3 in.x$\frac{1}{8}$ in. bars, $\frac{3}{4}$ in. spacing, 60 cycles

major surfaces of the individual bars were kept in a vertical plane to secure "chimney effect" as an aid to natural cooling. It should be noted that a true hollow square arrangement of conductors having the same number of bars, which is better located from the "skin effect" standpoint, has the same surface area, but does not lend itself to good natural ventilation. Fig. 1 shows the modified hollow square support.

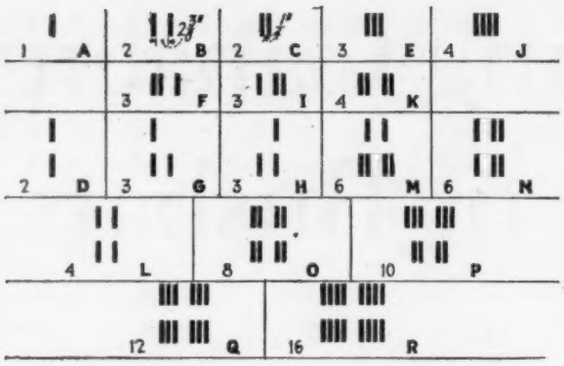


Fig. 3—Various Arrangements of Bars for Which Current Capacity Was Determined

4x¼-in. bars; center distance of 18 in. to return conductor

A large number of tests were conducted, extending over a period of about two years, with the object of ascertaining the capacity and merits of various busbar arrangements, and to discover simple rules governing current distributions in busbars so that the effect of changing from standard layouts might be predicted. All the arrangements of Fig. 3 were tested, some of them many times, to check the consistency of the results; 4x¼-in. copper was used for all the tests, and additional runs were made using 6x¼-in. copper. Similar tests were made on aluminum busbars. All tests were made at 60 cycles.

A motor-driven, three-phase, 60-cycle generator supplied power through a step-down transformer to a 14-ft. length of bus. Current control on the generator was secured by a rheostat in the generator field and was adjustable for any value up to 12,000 amp. Current readings were taken by ammeter from current transformers in the bus leads.

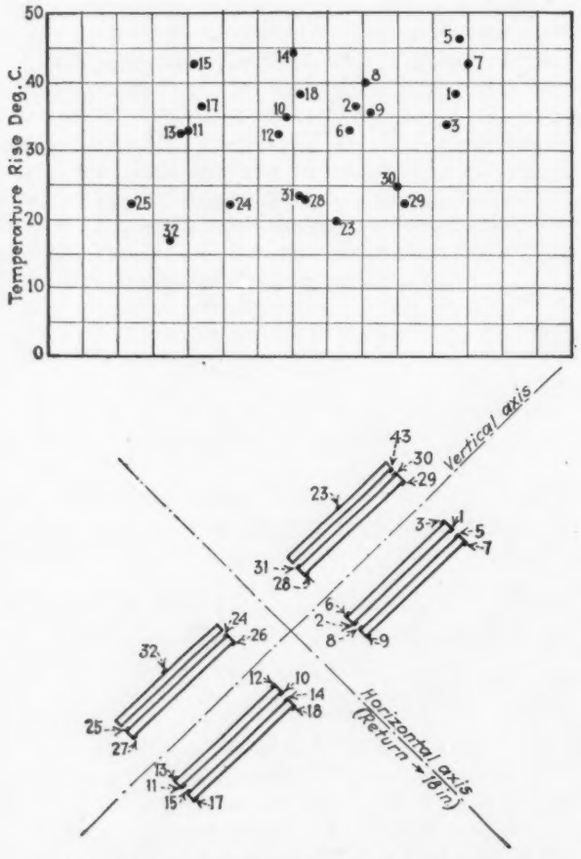


Fig. 4—Temperature Distribution Around Modified Hollow-Square Bus

Eight 4x¼-in. bars, 8,000 amp., 60 cycles. Thermocouple readings

Temperature Determines Capacity

As pointed out above, the current-carrying capacity of a bus is determined or limited by the permissible temperature rise. Open buses, removed from circuit breakers, switches or other devices of low temperature rating, can be operated up to 80 deg. C. without undue deterioration. The rate of oxidation increased rapidly with temperature increase. At high temperatures the danger of overheating in contacts, bus connections and joints is greatly increased. Where the bus may influence the temperature of other equipment, its temperature rise should not be greater than that allowed on the other equipment, unless the leads are amply designed to dissipate heat equivalent to the differential between the two equipments. A general temperature rise basis of 35 deg. C. is given for a maximum or hot spot temperature rise. With a 40-deg. ambient temperature this corresponds to a total temperature of 75 deg. The average temperature rise over a cross-section of the bus will be less than 35 deg. C., the range between hot spot and cool spot being determined by the number of bars and their configuration, resulting in an average temperature usually less than 30 deg. C.

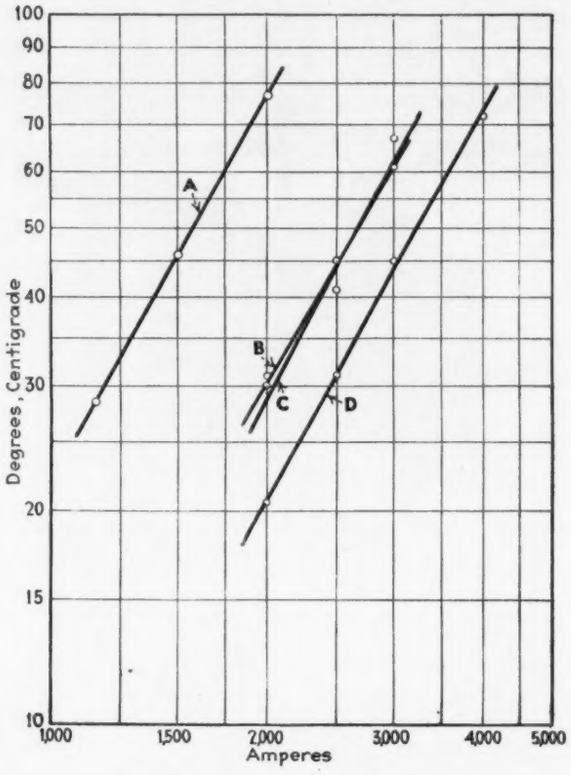


Fig. 5—Log-log Curves of Hot-Spot Temperatures

Used to determine 30 deg. C. rise rating from actual currents and thermocouple temperatures.

Curve	Size Bars	No. of Bars	Phase Separation In.	Arrangement	Amperes
A	4x¼	1	18	A	1,280
B	4x¼	2	18	B	2,180
C	4x¼	2	18	C	2,200
D	4x¼	2	18	D	2,650

Temperature indications were obtained by means of copper-"advance" thermocouples. A large number of these were applied on each lamination of go and return conductor at the center of the 14-ft. span. To secure consistent temperature indications it was necessary to have the copper-"advance" junction firmly in contact with the bus where the temperature was to be taken. A small felt pad was applied over the thermocouple bead to prevent heat flow from the bus and radiation to the atmosphere, which would have caused a slightly lower temperature indication than actually existed on the bus. To prevent heat flow along the thermocouple leads, they were securely fastened in contact with the bus and running in parallel with it for about 4 to 6 in. Thermometers were tried, but were not found satisfactory to obtain consistent indications.

To prevent cooling, due to drafts from open windows or doors, a cell structure, open at the top and about 10 ft. wide by 20 ft. long, was built up to shield the bus during test.

The rating of a given bus was determined by at least three tests with different current values; the results were plotted on log-log paper and the current for the chosen temperature limit was taken from the curves. In plotting the curve the temperature at the hottest point on the bus was used. Fig. 5 is typical of these log-log charts.

An examination of the curves for 4x¼ copper conductors (Figs. 6 and 7) shows that for the eighteen arrangements tested only a few are relatively efficient at 60 cycles so far as current-carrying capacity per unit of copper is concerned. Certain other arrangements are made necessary due to space limitations and in the following tabulation are indicated by an asterisk:

Arrangement as of Fig. 3	No. of Bars	Current Capacity for 35 Deg. C. Rise, Amp.
A	1	1,300
B*	2	2,200
D	2	2,600
E*	3	2,350
I	3	3,400
J*	4	3,000
L	4	4,200
N	6	5,400
O	8	6,000

Effect of Arrangement on Reactance

In long, heavy-current, low-voltage buses the inductive drop is often a serious consideration. To avoid a very bad current distribution due to proximity effect, a wide space between conductors has been necessary. By splitting up the multiple bar conductors into a number of one-bar circuits in parallel and by arranging that these single conductors are phased ABC ABC, and so on, with a comparatively short distance between phases, the reactance is materially reduced, the individual conductor current is reduced and the total voltage drop is reduced proportionally to the product of the reactance and current per conductor.

Such an interlaced bus is possible with the modified hollow square clamp, using arrangements described as A or D in Fig. 3, with the minimum spacing between phases necessary for voltage insulation.

General Rules

The following factors are fundamental with heavy current conductors and are presented here as general rules:

1. The surface area of the conductor affects the heat dissipation so that a laminated bus can carry more current than a solid bus, although both have the same amount of copper.

2. The laminations must be so arranged as not to hinder the natural movements of air currents—to obtain the maximum heat dissipation by convection.

3. In an isolated conductor of a number of bars in parallel, the magnetic flux linking inner bars is greater than that linking outer bars, the impedance of the inner conductors is greater and, consequently, the current density is greater in the outside conductors. This is known as "skin effect."

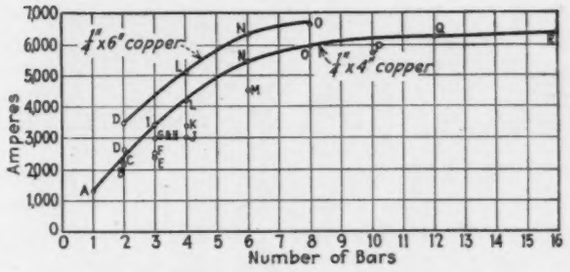


Fig. 6—Current-Carrying Capacities for 35 Deg. C. Rise, 60 Cycles

Letters refer to bar arrangements of Fig. 3. The practical limit of 6,000 amp. with the hollow square is double the limit with all bars in parallel (see Fig. 2)

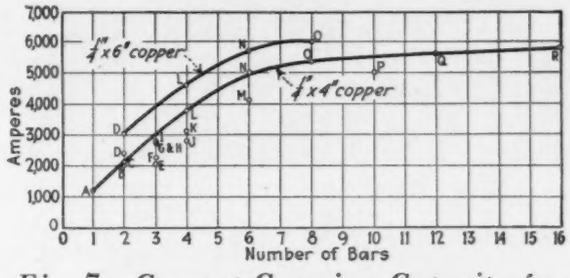


Fig. 7—Current-Carrying Capacity for 30 Deg. C. Rise, 60 Cycles

The practical limit is 5,250 amp.

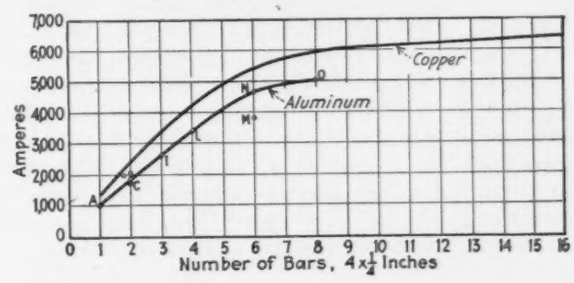


Fig. 8—Capacity of Aluminum Bus

Modified hollow square, 60 cycles, 35 deg. C. rise

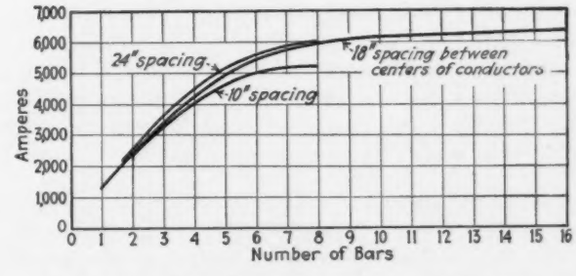


Fig. 9—Effect of Spacing of Return Conductor

4x¼ in., 60 cycles, 35 deg. C. rise; identical arrangements used

4. Where going and return conductors are close together, the magnetic flux of both conductors interlinks to draw the current into the adjacent bars of the two conductors. This is called "proximity effect."

5. The condition of the busbar surface affects the heat emissivity. A shiny conductor gets hotter than a dull-finished bar. Taping, painting, insulating with micarta or fiber board, all change the heat dissipation and consequently the current-carrying capacity for a given temperature rise.

6. If the thickness of a busbar is doubled, say a 4x¼ bar replaced by a 4x½ bar, the current-carrying capacity is only increased by 40 per cent. This is apparent when

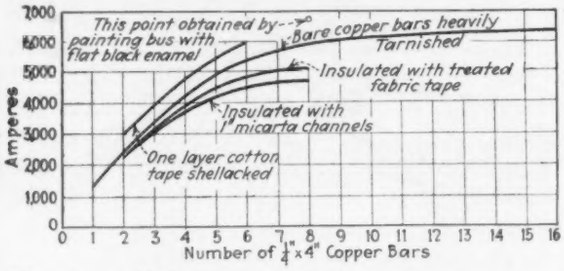

This point obtained by painting bus with flat black enamel
Bare copper bars heavily tarnished
Insulated with treated fabric tape
Insulated with micarta channels
One layer cotton tape shellacked
Amperes
Number of ¼"x4" Copper Bars

Fig. 10—Effect of Insulation in Limiting Current-Carrying Capacity

35 deg. C. rise, 18-in. centers, 60 cycles

it is considered that the radiating surface is increased but slightly, while the resistance is cut in half, so that with 40 per cent more current the watts which must be dissipated per unit of area are the same.

7. Due to 120 deg. displacement between conductors for three-phase buses, instead of 180 deg. as with single-phase buses, the proximity effect is not so great, so that better current distribution over each phase conductor is obtained. The data presented here, therefore, are on single-phase operation, but are applicable to three-phase buses.

Although aluminum has not been used as extensively as has copper for buses, certain advantages are claimed on the basis of lightness in weight. Analysis of the characteristics of the two materials usually used for busbars shows that aluminum has a conductivity of 60.9 per cent, as compared with copper at 99 per cent. Considering a 4x¼-in. bar for the same temperature rise with either material, the watts dissipated must be the same. Then the current which the aluminum will carry for the same temperature rise is $\sqrt{\frac{60.9}{99}} = 78.5$ per cent of what copper will carry. Therefore, assuming the same current density in a larger aluminum cross-section, the bar area would have to be increased to $1/0.785 = 127$ per cent of the copper cross-section; a bar ¼x5.1 in. would be required.

Aluminum busbar is supplied in sizes standard to copper fittings, the more common dimension being 4x¼ in. or 6x¼ in. The tests are reported with aluminum busbars of the former dimensions. Fig. 8 shows the capacities of aluminum conductor for the various arrangements of busbars.

Conclusions Reached from Test Results

The following conclusions may be drawn from the results obtained on these laboratory tests:

1. Points on the curves, Fig. 6 or 7, give capacities for a maximum copper efficiency for the number of laminations considered. Other arrangements, points below the curves, indicate greater copper per unit of current with the same maximum temperature.

2. Arrangements not coincident with the arrangements of points falling on the curve may be dictated by space limitations.

3. Capacities given according to Figs. 6 and 7 are on a basis of 18 in. center spacing to return conductors. The effect of changing this spacing is shown in Fig. 9. Generally speaking, proximity effect is directly proportional to the magnitude of the current and inversely proportional to distance between conductors. Where space is available, 18 in. between conductors is recommended.

4. Slight increases in capacities can be obtained with the standard arrangements shown in Fig. 3 by

(a) Painting the bars to increase convention losses.

(b) Increasing surface area of conductors.

5. An eight-lamination bus of 6x¼-in. copper in arrangement O, Fig. 3, gave 13 per cent more capacity than eight straps 4x¼ in. Fifty per cent more copper was used. This is illustrated in Fig. 6.

6. Insulated buses do not have as great capacities as non-insulated buses. Test results are shown in Fig. 10.

7. Buses with their major surfaces flat will not carry as much current as buses in vertical position. Test results are shown in Fig. 11.

8. An eight-lamination, single-copper bus (arrangement O with eight 4x¼ straps) will carry 6,000 amp. Skin effect is such a factor in conductors with more laminations that little gain is made. It is recommended that all alternating-current bus problems involving currents of 6,000 amp. or greater be referred to a specialist. Buses for 3,000 amp. or more can be profitably referred to specialists.

9. Tests on the aluminum buses indicate that a little better than the 78.5 per cent of the capacity of an equal

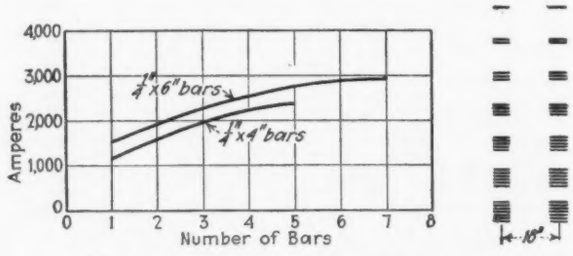


Fig. 11—Effect of Size of Bars (Horizontal Placements)

60 cycles, 35 deg. C. rise, ¼ in. between cars.

cross-section of copper can be obtained, the test results varying between 80 and 82 per cent.

10. The high capacity of busbars is dependent upon the proper arrangement of bars, good natural ventilation and the absence of outside influences.

Possible stresses in busbars due to short-circuit currents are a factor in bus design independent of conductor heating and should be given due consideration. It is necessary to know the capacity available on the bus, type of insulator and all physical properties of the busbar.

Where a busbar is brought in proximity to a magnetic material, flux may be created in the material, causing losses and heating. This problem also is treated separately.

A briefer item on bus capacities appeared in the Electrical World *on page 407 of the issue of September 1, 1928.*

White-Way Lighting Costs

By Glen Smith
Engineer of Construction City Light Department, Seattle, Wash.

Two-light Standards

Fluted bronze shaft and cast statuary bronze base and top.

RELIGHTING of the business section of Seattle was completed during December, 1928, when 10 miles of modern high-intensity street lighting was placed in service. Practically the entire business section of the city is covered by the new system, which serves altogether 51,000 ft. of street and cost $808,640. Outstanding features of the new system, aside from its extent, are the high and even illumination secured on the street and the beauty of the posts, which are believed to be the first decorative lighting posts of bronze to be installed in this country.

The old posts replaced were of cast iron, carrying five lamps each, with round globes spaced in a triangle. These posts were 14 ft. 3 in. to the top lamp and originally carried sanded globes with 50-watt, 8-volt lamps fed by transformers in the post bases. The illumination secured was from 0.32 to 0.79 foot-candles, which was considered high at the time the installation was made. Later the sanded globes were replaced by opal glass and the size of lamps increased to 100 watts each.

In contrast with the low posts with five small lamps, the new standards are 23 ft. 8 in. to the top lamp and are equipped with 500-watt lamps, supplying 2,820 cp.

One of Seattle's Relighted Thoroughfares Composing a Part of 10 Miles of New Street-Lighting Installation

Itemized Costs of Seattle Street Lighting Installations

Bonds, 5 per Cent	First Avenue Installation 12-Year	Union Street Installation 12-Year	Third Avenue Installation 12-Year
Property frontage assessed, ft.	37,200	18,295	34,291
Lineal feet of street lighting, ft.	21,000	10,500	19,500
Number of two-lamp posts	395	159	401
Number of three-lamp posts	171	98	137
Total number of posts	566	257	538
Average spacing, ft.	73	82	72½
Fixed engineering charge	$10,000	$5,500	$18,500
Accounting and collection charge	850	436	905
Advertising charge	70	69	70

Totals for Three Installations	
Number two-lamp posts	955
Number three-lamp posts	406
Total number posts	1,361
Total feet assessed	89,786
Total feet lighting system	51,000
Total cost	$808,640.87
Average cost per post	594.15
Average cost per foot assessed	9.01
Average cost per foot of system	15.86

Bid Prices	First Avenue Installation			Union Street Installation			Third Avenue Installation		
	Quality	Unit Price	Total Cost	Quantity	Unit Price	Total Cost	Quantity	Unit Price	Total Cost
Posts	566	$171.42	$97,023.72	257	$199.00	$51,143.00	538	$227.50	$122,556.90
Two-lamp post furnishings	395	191.81	75,764.95	159	192.35	30,585.65	518	169.60	*87,852.80
Three-lamp post furnishings	171	226.63	38,753.73	98	227.90	22,334.20	20	205.20	*4,104.00
Manholes	11	190.00	2,090.00	9	200.00	1,800.00	17	225.00	3,825.00
Handholes	...	.....	.....	...	.....	.....	22	37.50	825.00
Conduit in place (1 to 3½ in.)	34,600 ft.	.....	15,351.60	16,110	.....	6,405.68	34,430	.....	20,894.00
Lead cable (ten pair to three-conductor, 300,000-circ.mil)	39,010 ft.	.....	11,902.54	23,290 ft.	.....	8,762.68	40,880	.....	20,735.10
Removing existing cable	7,900 ft.	0.228	180.12	3,100 ft.	0.0345	106.95	11,700 ft.	0.01	117.00
Secondary cable reused	5,300 ft.	0.047	249.10	1,600 ft.	0.049	78.40	5,600 ft.	0.15	840.00
Transformers (15 to 75 kw.)	28	.....	13,956.52	15	.....	7,839.81	36	.....	21,332.40
Moving 25-kw. transformer	...	.....	.....	...	.....	.....	1	74.20	74.20
Oil fuse cutouts	64	53.35	3,414.40	30	53.30	1,599.00	84	59.85	5,027.40
Concrete post foundations	200 cu.yd.	16.77	3,354.00	165 cu yd.	12.95	2,136.75	310 cu.yd.	15.00	4,650.00
Removing and patching old post foundations	35	4.31	150.85	77	4.31	331.87	34	10.00	340.00
Street signs (double)	74 sets	20.70	1,531.80	33 sets	20.40	673.20	192 sets	21.50	2,193.00
Street signs (single)	3	11.75	35.25	2	12.06	24.12	6	11.00	66.00
Primary connection charge to be paid by city	...	.....	7,535.00	...	.....	4,510.00	...	.....	7,600.00
Cash payment per specification	...	.....	3,280.00	...	.....	1,520.00	...	.....	2,800.00
Credit for sale of existing transformers	...	.....	320.00	...	.....	60.00	...	.....	221.00
Total	...	.....	286,445.08	...	.....	146,358.16	...	.....	316,335.50
Interest and incidentals	...	.....	23,310.00	...	.....	10,950.00	...	.....	25,520.00
Total bids as per specifications	...	.....	309,755.08	...	.....	157,308.16	...	.....	341,855.50
Assessed valuation of property	...	.....	21,266,450.00	...	.....	6,133,570.00	...	.....	18,031,950.00
Final cost of improvement	...	.....	301,385.58	...	.....	158,905.40	...	.....	348,349.89
Cost per front foot assessed	...	.....	8.10	...	.....	†8.73	...	.....	†10.28

*Two-light posts on Third Avenue were changed to three-light after bids were let.
†Final cost of Third Avenue and Union Street installations subject to slight adjustment.

for the three-light standards and 1,880 cp. for the two-light standards. The minimum illumination on the street is 0.96 foot-candles. Provision is made in the wiring and transformers to double the wattage of the system when desired and all two-light standards may be changed to three, with comparative facility, by replacing the center cap with the third fixture.

The standards all have bases and tops of cast statuary bronze, with shafts of rolled bronze. The Union Metal Company furnished 538 of the posts and the remainder, or 823, were made by the contractor. The former have the rolled bronze shell over a rolled steel shaft, while the latter have the bronze shell filled with reinforced concrete.

Cast-bronze bases and caps for both types were made in Seattle. Base castings weigh 340 lb. each, the top for the two-light standards weighs 340 lb. and for the three-light 377 lb. The concrete post complete weighs 2,300 lb. The glass top used on Third Avenue and on Union Street is the General Electric No. 124, light "Alabaster" with rippled globe. On First Avenue the "Olympian" top of the Line Material Company was used. Both styles of globes have decorative bronze castings, dividing the globe into four panels.

The new lighting system was installed at the expense of the abutting property owners in accordance with the local improvement district plan. The completed system is maintained and operated by the city lighting department as a part of the municipal light and power system. The accompanying table gives detailed bid costs for installation.

500 Kw.-Hr. per Ton for Steel Castings

ONE steel foundry in the Middle West melted more than 23,000 tons of steel in one furnace in three years with an average consumption of 500 kw.-hr. per ton, according to the accompanying data. Delton T. Waby, Public Service Company of Northern Illinois, who furnished the information, points out that the average charge per heat was 5.8 tons and the average time between heats 10.2 minutes. The melting time averaged one-third of an hour per net ton. During the period covered by the record the electrode consumption averaged 5 lb. per net ton of metal melted. It may be observed that the unit energy and electrode consumption vary inversely as the output of melted metal. Miscellaneous steel castings are produced with the furnace output.

Automatic Capacitor Control for Industrial Plant

By L. Stone
General Electric Company, New York

SINCE many of the motors driving the machines used in the manufacture of plaster products at the New Brighton (N. Y.) plant of the United States Gypsum Company call for either high-starting or pull-out torque, the average power factor has often been 0.60 or below.

The Staten Island Edison Company furnishes power to the Gypsum company at 6,600 volts to banks of transformers totaling 5,000 kva. The utility company did not consider such a large low power factor load to be desirable and offered a special rate contract whereby the customer would receive a substantial bonus if the average monthly power factor was kept between 0.95 lagging and 0.95 leading.

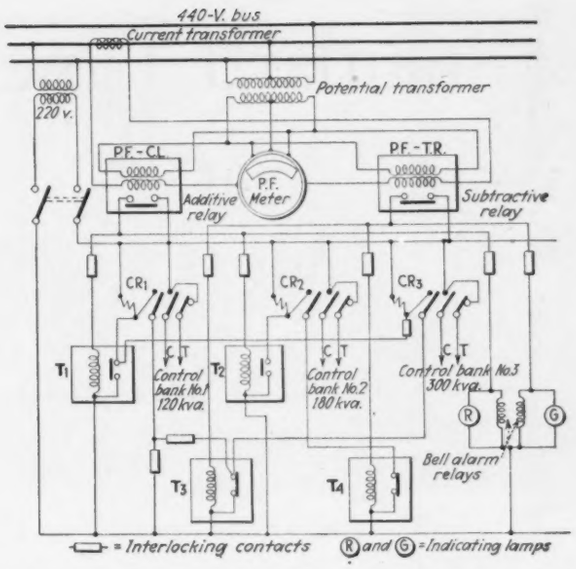
As the use of overexcited synchronous motors on the large machines did not provide sufficient leading kilovolt-amperes capacitor banks were installed. The banks vary in size from 60 kva. to 300 kva. and total 2,700 kva. for the whole plant. They are located in the two transformer substations and are connected to motor group feeders at various points in the mills. These capacitors brought the power factor within the required range under all conditions of plant operation, but constant vigilance was required on the part of the plant electrician, who had to check meters continually and close or trip manually operated breakers controlling the various banks of capacitors. Since the plant was large, this service required most of the time of one man, hence some automatic method of controlling the power factor was deemed desirable.

Since no standard equipment for this service was available, a special panel was assembled and arranged to control three banks of capacitors rated 120, 180 and 300 kva. It was assumed that this amount of capacitance would take care of the usual variations in power factor caused by variations in the plant load. The other capacitors were left arranged for manual operation, as might

Three Years' Record of Large Electric Steel Foundry

Net Tons per Month	Kw.-Hr. per Net Ton	Melting Time per Net Tons, Hours	Electrode Consumption per Net Ton Graphite (Lb.)	Charge per Heat (Net Tons)	Time Between Heats (Minutes)
581	479	0.372	5.7	5.4	8.1
417	491	0.362	4.9	5.0	7.5
465	486	0.37	5.4	5.2	7.8
504	493	0.358	5.11	5.66	11.32
598	482	0.36	5.16	5.44	10.88
673	482	0.353	4.61	5.46	10.92
698	479	0.305	5.89	5.81	7.51
662	485	0.300	5.69	5.61	7.35
521	491	0.288	4.58	5.54	7.25
776	488	0.319	4.47	5.74	7.5
813	482	0.316	5.34	5.60	11.2
807	486	0.331	5.39	5.74	11.48
796	492	0.345	5.88	5.81	11.62
584	507	0.355	5.66	5.73	7.00
632	490	0.346	6.75	5.80	7.01
810	481	0.306	4.25	5.95	7.26
525	483	0.322	4.62	5.70	6.84
660	496	0.348	4.18	4.73	6.89
730	482	0.329	3.09	5.98	8.97
821	483	0.323	3.25	6.03	10.25
748	497	0.328	4.46	6.09	9.74
829	490	0.311	4.2	6.28	12.56
645	495	0.313	5.1	6.48	13.96
833	488	0.313	4.5	6.3	12.6
808	486	0.322	5.24	6.08	12.16
809	488	0.321	4.8	5.95	11.90
819	499	0.325	4.73	4.61	11.22
580	519	0.381	5.31	5.79	11.58
464	527	0.368	5.32	6.19	12.38
400	546	0.372	5.3	6.15	12.30
569	532	0.354	5.63	6.12	12.24
535	543	0.374	4.95	5.88	11.76
511	553	0.411	4.90	5.74	11.48
575	546	0.38	6.62	6.18	12.36
576	543	0.36	5.41	6.27	12.54
565	538	0.38	5.51	6.29	12.58
Average 648	500	0.332	5.08	5.84	10.22

From 1929 Hunt Award paper, Western Society of Engineers.



Manual Control of Capacitors Eliminated by Automatic Operation

In operation, when the power factor falls below 0.95 lagging relay *PF-CL* closes and energizes timing relay *T1*. If the condition persists for ten seconds the timer energizes contactor *CR1*, which operates the breaker to connect the 120-kva. bank of capacitors to the line. In case this is insufficient to bring the power factor within the limits or in case *PF-CL* is closed again by further changes in plant operations timer *T2* acts to close *CR2* and closes the breaker which serves to connect to the system the 180-kva. bank of capacitors. In a similar manner *T1* may be again energized through the interlocking circuits to close *CR3*, thereby bringing the 300-kva. bank of capacitors into service.

The three banks are disconnected from the system by similar operation of *PF-TR*, which closes at 0.95 leading power factor, thereby operating *T3*, which de-energizes *CR3* and trips the breaker on the largest group. Should this prove insufficient *T4* will operate to de-energize *CR2*, then *CR3* will operate again to open *CR1*. This procedure disconnects all of the automatically controlled banks from the system.

be indicated by signals actuated by the automatic equipment. As the plant grows more banks of capacitors can be added to the automatically controlled group.

The control elements on the panel are two induction type power-factor relays, as shown on the accompanying diagram, *PF-CL* and *PF-TR*, which respectively serve to add and subtract capacitance. To each are connected adjustable timing relays which are set for about ten seconds to prevent operation on demands of very short duration. The timing relays *T1* and *T2* are used with the adding controlling elements, while *T3* and *T4* are used with the subtracting elements. Auxiliary contactors *CR1*, *CR2* and *CR3* are in turn controlled by the timing relays and serve to operate the breakers on the individual banks of capacitors which are equipped with motor-operated merchanisms.

The equipment acts in response to demands within the limits of its corrective ability. Should the power factor go either way beyond the limits after the automatic system has fully functioned a bell alarm rings in the electrician's shop and red or white lights indicate whether the manually operated banks of capacitors are to be connected or disconnected. By the use of this automatic capacitor control system the power factor is held within the bonus-earning range except under infrequent abnormal conditions and the electrician who had previously devoted all of this time to holding the power factor is released for other work. When an abnormal power-factor condition arises he is not only notified of the fact but is directed as to what operation is necessary to bring about normal conditions. It is assumed that the savings thus made possible will pay for the equipment during the first year of operation.

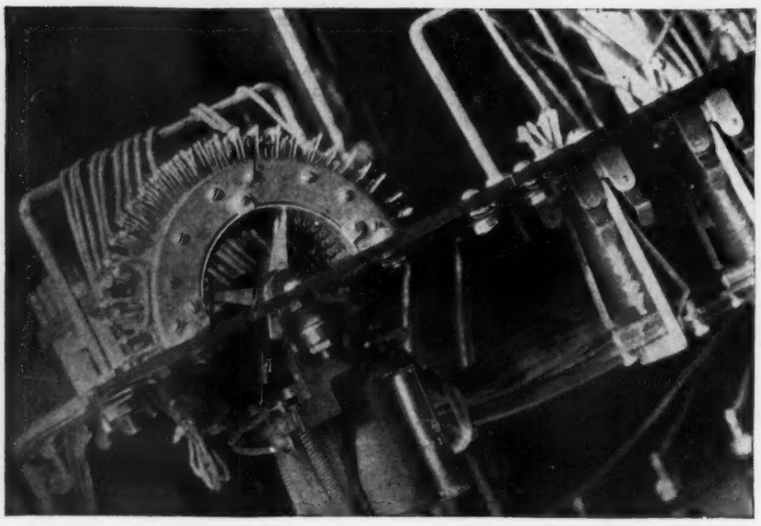
Electric Welding on 277-Mile Gas Pipe Line

A GAS pipe line from Rock Springs, Wyo., to Ogden and Salt Lake City, Utah, 277 miles, is being built of 18-in. and 16-in. arc-welded pipe and the joints are being arc welded in assembly. The contour determines the number of sections to be welded together before they are dropped into the trench. These lengths are lined up on shores over the trench and mounted on rollers so that the section may be rotated to facilitate the welding.

Each pipe joint is first tack welded, to prevent buckling from the desert heat, and then arc welded twice with two separate beads to guard against pinhole leaks; $\frac{3}{4}$ lb. of electrode metal is deposited on the first and $1\frac{3}{4}$ lb. on the finish weld. Of course the welding of section to section in the trench has to be performed without rotating the pipe. Joints are welded on the shores at the rate of eight to twelve per man per day and in the trench at the rate of six to eight per man per day.

The Uinta Pipe Line Company is using ten "Stable-Arc" Lincoln welding outfits driven by gas engines and mounted for team hauling. Although this is the first job on pipe as large as 18 in. it is estimated that the cost of arc welding the joints will prove to be less than that by other methods. It is certain that the joints will be strong and durable.

Roller Mounting Facilitates Arc Welding of 18-In. Pipe Joints



Notching Relay Divides One Revolution Into 50 Seconds When Actuated at One-Second Intervals

Standard Timer *for* Meter Calibration

By E. L. KELLER

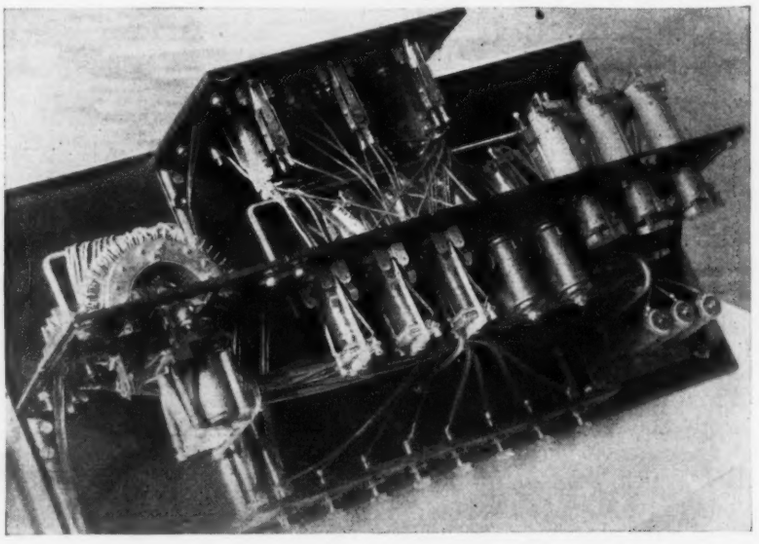
Duquesne Light Company, Pittsburgh, Pa.

FOR quite a long time there has been need for an accurate timing device by means of which rotating standards and watt-hour meters may be accurately calibrated. Many meter and test departments have striven to develop the accuracy of their timers and to eliminate errors regardless of how small they may be.

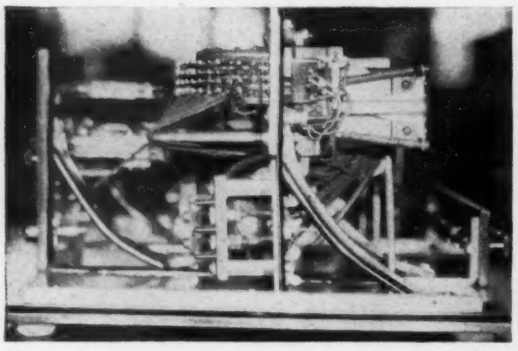
The meter and test division of the Duquesne Light Company has finally developed a device which it calls a standard timer. This device starts and stops electrical measuring apparatus according to the interval at which it is set to operate.

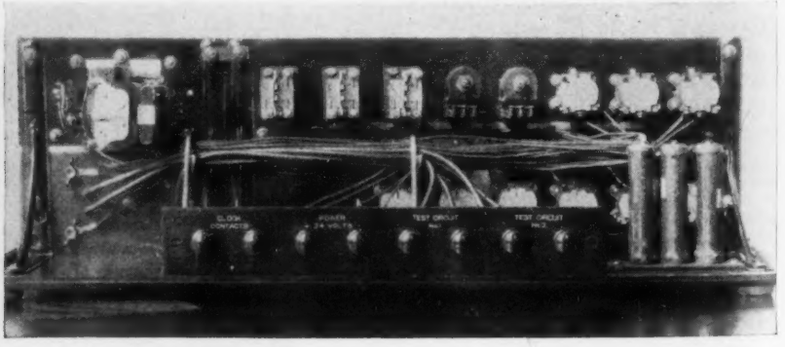
The apparatus consists of a notched relay which is a relay similar to those used for supervisory control and automatic call systems. It operates on 24 volts, requiring less than 2.4 watts for its operation. The control of this relay or timing impulse, which is the nerve center of the apparatus, can be had from a contact on a clock pendulum or an arrangement on a Warren motor.

For our purpose we used a clock pendulum fitted with a mercury contact. The contact operates a tele-



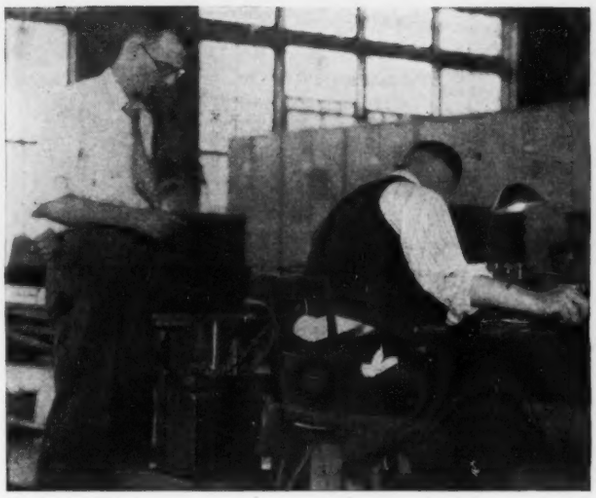
Notching, J, Line and Type 44 Relays Used in the Timing Device

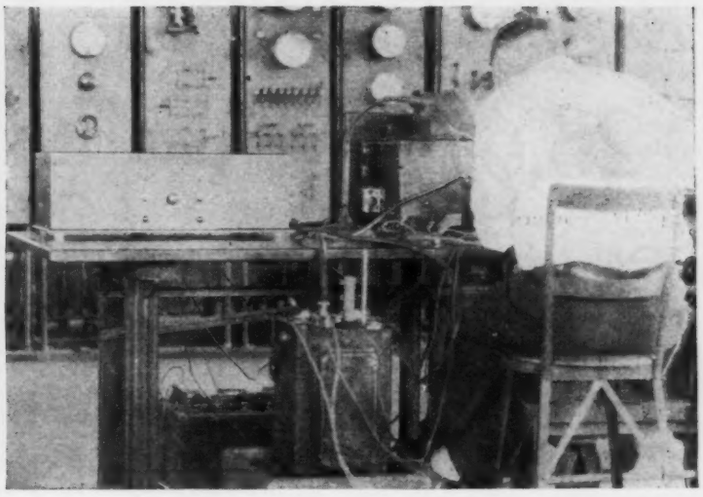




End and Back Views of the Timer

In the end view the cover is removed to show the notching relay and test circuit relay. In the back view the resistance units are wired in series with the pilot lamps to prevent burning out if the power circuit should be 30 volts or more.

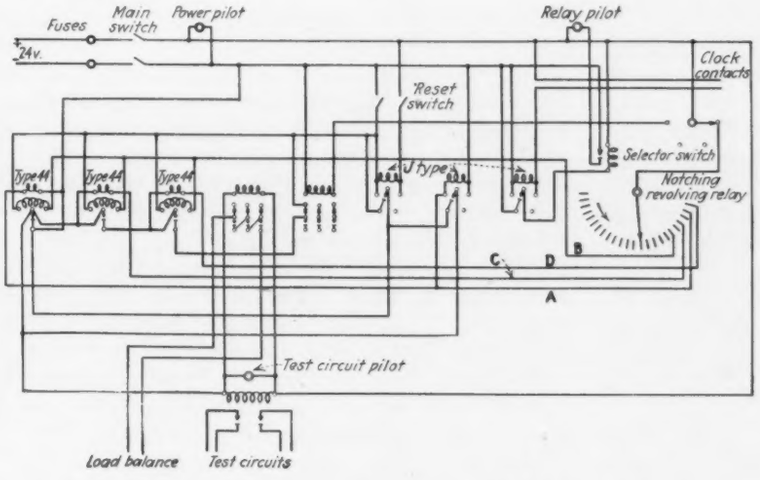




Old and New Methods of Timing

The old method required two men and a stop watch and accuracy was on the order of one-half of 1 per cent. The new method of timing requires only one man and accuracy is increased and time saved.

phone type "J" relay on a 24-volt circuit and draws less than one-tenth of an ampere. The "J" type relay actuates a notching relay similar to those used for supervisory control and automatic call systems.

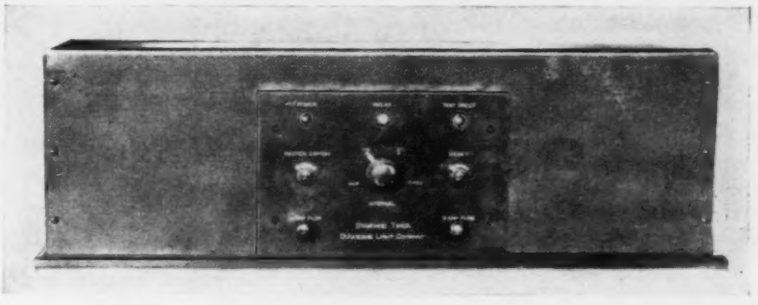


Wiring Diagram of Timer Adjusted for 96-Second Interval

The heart of the device is the notching relay. This relay divides one revolution up into 50 seconds when actuated at one-second intervals. If the time interval is less than 50 seconds relays can be directly connected to start and stop a test circuit. But where the time interval is more than 50 seconds, which is one revolution, intermediate relays are necessary to defer the operation of the test circuit relay. The intermediate relay is a Western Electric 44 type, provided with a line coil and a restoring coil. The relays as mounted on the timing device from left to right are: The notching relay first; this particular relay has four tiers of contacts. The second three relays are the "J" type mentioned previously. Fifth and sixth are line relays, merely used to open a circuit when set on one of the four time intervals. Seventh, eighth and ninth are the 44 type relays. These relays defer the operation of the test circuit one revolution for each relay.

By the use of this device we have been able to increase the accuracy of calibration to a great extent and feel that we can now make measurements to a degree of accuracy beyond anything we will be asked to do. This device also eliminates the time of one man. The timing was usually done by an extra man not making the electrical measurements.

The high degree of accuracy is claimed on the identical time interval of repeat checks. It is now customary to get three or four identical successive checks, whereas before anywhere from two- to six-tenths of a second variance was a common thing, especially where a stop watch was operated for long periods at a time. Fatigue and carelessness result where a man is at a high state of nervous tension in order to get the most out of stop-watch operation. This timing device entirely eliminates the stop watch and operator.



Exterior of Standard Timer for Laboratory Use

Engineering Data on

23,674 Miles of "High Line"

Wide diversity exists in line structure. Practice greatly affected by local conditions.

Spacing, sag, clearance and span differ on lines similar as to voltage and load.

Steel structures and wood both extensively used; preference differs according to section of country.

Country-wide survey affords opportunity for comparison and greater unification in future.

THE diversity of practice in transmission-line construction is the first impression given by an inspection of the tabulated data in the supplement accompanying this issue of ELECTRICAL WORLD. Certainly, if standardization indicates that the period of growth and experimentation has gone by, there need be little fear of stagnation in this field for some time to come. Thus far variety is the rule.

Only lines operated at or above 66,000 volts were included in the survey, which covers a mileage equivalent to eight times the width of the country from coast to coast, and in which all sections are well represented, as the summary shows. Comments can scarcely go beyond generalities; detailed analysis must be left to the individual user.

In one feature that somewhat affects the performance of the line but that is not directly under the control of the transmission engineer there is great uniformity. In most localities 60 cycles is standard. The chief exceptions are the 50-cycle region in southern California and an area of 30-cycle operation in Michigan. The extensive 25-cycle system in western New York does not appear, being operated somewhat below the 66 kv. adopted as the lower limit for the survey.

But when one comes to constructional features the uniformity vanishes. Although most of the lines are comparatively new, there are a variety of voltages; 66, 110 and 220 kv. predominate, but 69, 75, 120, 132 and 140 also appear.

Structures are of both wood and steel. In the West the former distinctly predominates, being used even with very high voltages where wide conductor spacing and generous clearances must be allowed. One 220-kv. line in California is carried on this material with 500-ft. spans and heavy conductors. Every company in the West South Central States reported wood, with voltages up to 132 kv. in one case. Generally the form is H-frame with 20-ft. to 29-ft. cross-arms, and spans rarely exceeding 600 ft. At 66 kv. wood is used both in H-frame construction and in single poles. In numerous instances where no form was mentioned it is probably safe to assume single poles.

Steel towers range from rigid, with square base of generous dimensions, to flexible A-frame construction, and average spans are reported up to 1,280 ft. The new 220-kv. line of the Public Service Electric & Gas Company of New Jersey uses 1,100 ft. More commonly the spans appear to vary between 600 ft. and 900 ft.

Corresponding variations in stringing tension, sag and tower weight follow, running up to the extraordinary maximum on one short line, with special construction, of the Louisville Gas & Electric Company of more than 100 tons for tower weight and a tension of 29,000 lb. At the other extreme, usually on light lines serving a scattered population, are spans as short as 200 ft., very moderate ground clearances, as low as 20 ft., and sags of 30 in. On such lines the prevailing span length is 250 to 300 ft.

While copper is the most commonly used conductor material, there is a considerable mileage of aluminum, generally as steel-reinforced cable. Uniformity of spacing is conspicuous by its absence. In some instances it would seem that definite provision has been made for future operation at a higher voltage without requiring any important reconstruction. Thus 66-kv. lines are built with spacings of 72, 84, 96, 108, 114, and 150 in. Conductor arrangements, while more frequently vertical than otherwise, may or may not include an offset. In many cases the horizontal arrangement is used, especially with wood-frame construction. Triangular spacing is sometimes equilateral, sometimes right-angled, sometimes of still other shapes.

Insulation near terminals in general is not reduced, though there are many exceptions, nor is the use of arcing horns and arcing rings prevalent.

For protection against lightning the several well-known commercial forms of arrester are utilized, but here again numerous exceptions are to be found. Quite a number of companies dispense with them entirely. A comparison of operating records might be worth while.

Most designers have come to accept overhead ground wires, but diversity exists in the material used. Where stranded steel is used there seems to be a distinct tendency to employ it also for tying the towers together longitudinally; high-strength or extra-high-strength steel is specified.

For communication along the lines either private or commercial systems are used — often both. The former seem to predominate, but the extent can only be determined by tabulating

Summary of Lines and Mileage Covered in Transmission-Line Survey

Region	No. of Lines	Miles
New England	65	1,345
Middle Atlantic	111	2,522
East North Central	194	3,841
West North Central	59	1,569
South Atlantic	52*	2,758
East South Central	64	2,462
West South Central	126	4,011
Mountain	12	509
Pacific	194†	5,018
Total	877	23,674

*Counting entire Duke Power sytem as one.

†The number of entries is less because 136 lines of Southern California Edison Company are condensed into 22 entries.

the mileage of each. Where the entry is omitted or given as "none" commercial service is presumably used as needed. The prevalence of carrier-current telephony is to be noted. A few companies also report wireless.

Earnest efforts were made to have the tabulation include every line within the range specified in the United States. The only known omissions are those of companies associated with the Electric Bond & Share Company, the North American Company and some of the lines of the Southeastern Power & Light Company. Of the last-named, however, those of the Alabama Power Company are included. Otherwise the table is believed to be complete.

So far as practicable items are entered as reported by contributors. This causes differences in expressing the same facts, but enables the reader to make his own interpretation in case of doubt.

Power Plants in Chile

CENTRAL electric light and power service in 210 cities in Chile is summarized in Special Circular No. 579 (revised) recently issued by the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C. The information covers the location, name of company or owner of plant, capacity in horsepower and kilowatts, secondary distribution as to type (a.c. or d.c.), voltage, phase, frequency and class of plant as to source of primary energy.

Most of the plants are quite small. The exceptions are the one at Santiago of 110,000 kw., one at Tocopilla belonging to the Chile Exploration Company of 93,000 kw., one of 30,000 kw. at Potririllos belonging to the Andes Copper Company, and one of 28,000 kw. at Rancagua owned by the Braden Copper Company. The three last named are apparently not central stations in the usual sense. In addition, there are twelve other plants ranging in capacity from 1,060 to 5,440 kw.

The prevailing distribution voltage appears to be 220; 110 volts is rare; combinations of 220-440 and, to a less extent, 220-380 are common. Direct current appears to be used in as many towns as alternating and is by no means confined to the smallest plants; where alternating current is generated, it is almost invariably at 50 cycles, three phase.

Letters from Our Readers

Disclosing the Cause of Accidents

To the Editor of the ELECTRICAL WORLD:

With your recommendation that analytic study of causes of electrical accidents can be productive of valuable conclusions, few will disagree.

It is, however, a fact apparently not known to the writer of your August 3 editorial that such analysis has been quietly going on for a considerable time and some of the conclusions have had a limited distribution where they are of use within the industry, but no publicity has been sought. The reasons for the avoidance of general publicity are several. Obviously, details of individual cases cannot be published. Ofttimes causes are obscure, or not clearly determinable. In such cases an authentic statement would not be available. This has delayed accumulation of dependable data.

Doubtless the ELECTRICAL WORLD did not intend to suggest publication of details of individual cases. As to accumulative statistics, it has not been considered until recently that sufficient data were available to warrant generalizations. However, with data now in possession of the accident prevention committee, it is preparing to publish some analyses at an early date.

With one of the statements in the editorial disagreement is necessary. Contrary to the statement, there has not been an appreciably marked absolute or relative reduction in fatalities in the electric utility industry. This is not a comfortable admission. Except for the last two years, national statistics gathered by the accident prevention committee show no decrease in annual fatalities per thousand employees for the period from 1923 to 1928, when the ratios were as follows: 1.7, 1.6, 1.7, 1.7, 1.4, 1.4. C. R. BEARDSLEY,

Chairman Accident Prevention Committee.
National Electric Light Association,
New York City.

"Circuit Breakers Without Oil"

In the issue of the ELECTRICAL WORLD for August 24, on page 366, under the heading "Circuit Breakers Without Oil," you say at the bottom of the page, "Now it is reported from Germany that a new oil-less circuit breaker has repeatedly broken 500,000 kva. This new breaker is based on a principle diametrically opposite to that of the vacuum breaker. It forces compressed air into the arc and blows it out. It is, indeed, encouraging to find that, after many years in the circuit-breaker field barren of new ideas, three promising methods of switching have been brought out in such a short time."

I need not quote the rest, but I do find that I am compelled to take exception to the statement as to the *newness* of the air-blast circuit breaker; in fact, it appears for the first time in the art in my U. S. patent No. 265,936, "Means for Preventing Flashing between Electric Conductors," and dated October 10, 1882, and which went into extensive use on the T-H arc machines, as is well known. The mechanism itself for furnishing the air blast appears in patent No. 273,406, of March 6, 1883, but more to the point than these is my patent No. 520,809 on "Means for Preventing Arcing in Electric Power Stations," which was filed September 1, 1890, and issued June 5, 1894, the filing being nearly 40 years ago. The patent shows a power station provided with an equipment for using a powerful air blast on the breakers. As a sample of the claims which relate to the use of the air blast, I quote the first claim, as follows:

> The combination in an electric power installation of the various circuit-breaking apparatus as described, used in connection therewith, with an air or other insulating fluid distribution system, arranged to deliver a jet of air or like fluid across the arcing space at any desired or necessary one of the said circuit-breaking apparatus, and an electromagnetic device connected with the general electric circuit of the installation and a controlling means for supplying the insulating fluid and itself controlled by devices operated by the pressure in the air system, as and for the purposes set forth.

I have always believed that the time would come when breakers of this type would be used, but I hardly thought it would be necessary to wait so long as 40 years, but surely let us not have these things called *new*, when they have *been in our art here in the United States without need of importation.* ELIHU THOMSON.

General Electric Company, River Works,
West Lynn, Mass.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Tests of an "Atmos" High-Pressure Boiler. — The essential feature of the "Atmos" boiler consists in the continuous rotation of the tube from which the steam is generated. This boiler, which is built for a pressure of 1,565 lb. per square inch, comprises two squirrel-cage rotors, each of a heating surfact of 247.5 sq.ft. arranged in the longitudinal direction. The superheater is mounted immediately above them and flanked on each side by one-half of the feed-water heater. The two halves of the latter are arranged in parallel as regards the water circulation, and each presents two passes in series for the flue gases. The rotors are placed in the upper part of a pulverized coal furnace fitted with two burners and arranged for the fusion of the ash. The feed-water circuit comprises two stages, the first working at a low pressure of about 15 lb. per square inch and the second at a pressure corresponding to that of the boiler. In order to determine the conditions of operation readings were taken at frequent intervals of: Quantity of water evaporated; pressure and temperature of superheated steam; feed-water temperature at entrance to low pressure; temperature of the composition of the gases at the economizer exit, and the power delivered by the back-pressure turbo-generator. The article includes data, observations and conclusions regarding the applicability of the equipment for various purposes. — *Engineer (England)*, August 30, 1929.

Electric Control of Steam Boilers.— M. Moeller. — Economic operation of boilers calls for attendance which follows constantly the changing power demand of the station. To lessen the burden upon the boiler room crew semi-automatic, and in some installations fully automatic, regulating devices have been installed which tend fuel, draft and under pressure in accordance with the steam demand. These devices are hydraulically operated and share, therefore, the disadvantages common to this type of equipment, such as complexity, leaky joints, sluggish operation and "hunting." The author describes the latest type of fully automatic boiler control with electric transmission, which avoids these shortcomings, and has such wide flexibility as to be applicable to a single boiler or a battery of them. Since there is always a definite relation between pressure, fuel and draft, a Wheatstone bridge arrangement lends itself readily to the proper correlation of these variables. A specially designed, highly sensitive pressure gage, consisting of a small spring-balanced rotating piston, acts upon a circular glass tube resistor, partially filled with mercury, so as to alter the amount of ohmic resistance in one or more branches of the bridge, which, in turn, regulates the fuel admission or speed of grate motion and the draft. In the diagonal of the bridge is placed a relay for the control of the pilot motors. A delay is interposed to allow the steam pressure time to respond to the change in demand. Carbon dioxide and under-pressure meters can be added to the control. If several boilers are to share a given supply in proportion to their size a special "ratio-shifter" can be included in the Wheatstone bridge.— *Siemens Zeitschrift*, July, 1929.

Units, Measurements and Instruments

Remote Indicator. — A. Imhof. — A considerable number of principles are known, whereby the indication of an instrument or any angular motion can be transmitted electrically over any desired distance. Eleven major methods are enumerated by the author, adding a twelfth recently developed induction principle. A ferro-dynamic transmitter is used, consisting of a laminated horse-shoe type stator, in the gap of which turns a moving coil in astatic equilibrium. A second, identical instrument serves as receiver. The two stators are in parallel and receive single-phase a.c. excitation. The two rotors are in series. If the rotor of the transmitting instrument is given a turn of a certain number of degrees not exceeding 90 deg., the rotor of the receiver will exactly duplicate that angular motion. The transmitting rotor is mechanically connected to any desired instrument, a level float, a tachometer, etc., and any number of receiving rotors can then be actuated at a distance, the system requiring four pilot wires. — *Revue Générale de l'Electricité*, August 10, 1929.

Dead-Weight Gage for the Direct Measurement of High Steam Pressures. —G. S. Callendar.—It is pointed out that when using high steam pressures, particularly those above 2,000 lb. per square inch, it is desirable to obtain a more direct method of observing the pressure than is possible when using the ordinary Bourdon-tube gage. Accordingly a special arrangement has been devised whereby the pressure water is taken from the oil pressure gage tube after the tube has passed through a cooling water bath. It is then taken directly to an oil water separator, especially designed to eliminate carry-over of oil. The dead-weight gage has a differential floating piston from which suitable weights may be suspended. Details of the installation are described as well as the operation for successful results. It is said that the slightest changes in the conditions under which the boiler is operating are instantly shown on a magnified scale on the spring balance. These changes may be much too small to be shown by an ordinary tube gage, but are clearly indicated under all circumstances. Results are said to be highly satisfactory.—*Engineering (England)*, August 30, 1929.

Generation, Control, Switching and Protection

Experiences with Reactance Coils.— G. Levi.—Following an inspection of American power plants, the municipal electric works of Berlin, with its extended 30-kv. cable system, started an investigation regarding reactance coils in the stations. The article describes in its first part theoretical considerations and various types of available reactors, grouping them into cylindrical coils, disk coils and cable coils. For its specific use the Berlin system has adopted a 30-kv. disk type design with fireproof spacers and porcelain legs. Excessive heating, dynamic forces and flashovers have caused faults which are described and investigated. Based upon these experiences, specifications are given to which such reactors must conform to be acceptable to the Berlin system. Among these requirements may be mentioned four-times test voltage between terminals, four-times normal impulse test, no floating metal parts, no soft solder, tie bolts of fireproof material, temperature rise not over 150 deg. C. and 20 seconds test with permanent short-circuit current. — *Elektrotechnische Zeitschrift*, August 15, 1929.

Telegraphy, Telephony, Radio and Signals

Variable Inductance Radio Tuners.— T. E. Lander.—The author has introduced an unusual idea to prove the possibility of dispensing entirely with the use of tuning condensers in radio sets and substituting therefore variable inductance radio tuners. There is no sound argument against the use of tapped coils, except the difficulty of obtaining a really reliable tapping switch or plug-and-socket device and some means of final adjustment which will allow of exceedingly small variations in inductance and, at the same time, cover a fairly wide band of wave lengths, so that the tappings may not need to be too frequent, and all the stations lying between one tapping point and the next may be tuned successively. Various design factors have been offered, including a characteristic curve and circuit diagram for the set to be constructed along this line. The author states that it is not proposed, because there are too many variables to make a theoretical value sufficiently approximate to the actual to be of practical

use, to calculate the theoretical limits of inductance variation obtainable by means of a system similar to the one illustrated; but as the tendency appears to be to complicate rather than to simplify the constructional details of sets, and to increase rather than to reduce the number of necessary components embodied therein, it has been the author's aim to describe briefly a practical method of simplifying the tuning arrangements and, at the same time, increasing their efficiency in any set wherein straight aerial-tuning and reaction are employed.—*Electrical Review (England)*, August 16, 1929.

Electrophysics, Electrochemistry and Batteries

Prevention of Ionization in Impregnated Paper Dielectrics.—S. G. Brown and P. A. Sporing.—An account of the work which was undertaken to study the performance under various conditions of paper-dielectric condensers such as are commonly used for power-factor correction. The research tends to indicate that the breakdown of dielectrics in service is due to ionization of entrapped air and that the removal of the air being impossible the design of cables and condensers should be such as to prevent ionization. The principle of this design is to subdivide the dielectric. The effect of surges in causing breakdown is also indicated, and a new test for finished products is suggested. The authors state that if the dielectric contains air it is not possible to prevent ionization by increasing the dielectric thickness except to a prohibitive extent. In other words, the absolute potential rather than the potential gradient is the deciding factor. It is also stated that it is quite possible to have two condensers with identical potential gradients, one in a most unsatisfactory condition and one working quite well. The correct method, it is concluded, of building a dielectric to work at a given voltage is not to increase the thickness so that ionization is prevented by this means, since economic considerations render this virtually impossible, but to arrange that the dielectric consists of a number of series sections, such that the voltage across any one section shall not exceed that required for ionization.—*Journal of the Institution of Electrical Engineers (England)*, August, 1929.

Electrical Insulating Papers for the Manufacture of Power Cables.—T. N. Riley and T. R. Scott.—Following a brief review of the subject of cable insulating material, it is demonstrated that in the past attention has been directed almost exclusively to the fiber stock and the relation of the physical structure to the electrical properties. The characteristics which a cable insulating fiber should possess are then outlined. These are said to be high electric strength, high oil absorption, low electrical conductivity, high mechanical strength and permanence. The results of tests designed to determine the relation of the paper structure to these qualities are then quoted and discussed, and it is concluded that a satisfactory paper for a power cable insulation has the fiber closely packed to give low bulk while still retaining high absorbency. The fiber packing should not, it is stated, be obtained by heavy surface calendering.—*Journal of the Institution of Electrical Engineers (England)*, August, 1929.

Electrotechnics, High-Voltage Building.—Among the researches of the electricity department of the National Physical Laboratory has been included the development of equipment for high-voltage building in which dielectric losses may be determined at 150 kv. Three air-cooled transformers, together with insulating stands and incidental equipment, were arranged for the test and the details of the installation have been given. The method of making the current and voltage measurements has likewise been elucidated and other investigations in high-voltage current measurement have been indicated.—*Engineering (England)*, August 16, 1929.

Transmission, Substations and Distribution

Automatic Voltage Regulator. — P. Toulon.—A description of an unusual apparatus for maintaining a.c. energy up to 250 watts at absolutely constant potential, in spite of great variations of the supply voltage. The inventor utilizes the principles of electric characteristics and achieves his purpose without any moving parts. An ohmic resistance with a straight line current characteristic and a set of neon tubes with a parabolic current characteristic and a small auto-transformer are connected differentially in parallel. With properly chosen ratings of these three component parts of the circuit, a supply voltage varying plus minus 10 per cent can be changed into a regulated potential staying within plus minus $\frac{1}{10}$ per cent. For a regulator of 125 watts a battery of 20 neon lamps is required, or 40 neon lamps for an output of 250 watts.—*Revue Générale de l'Electricité*, August 3, 1929.

Mechanical Characteristics of Transmission Lines Showing Effect of Change in Mechanical Conditions of Continuous Equal Wire-Spans Supported by Suspension Insulators from Points at Equal Elevations.—Seiichiro Noda.—It is pointed out by the author that when a transmission line is constructed by employing suspension insulators it sometimes occurs that a load on a particular wire span or spans changes, due, for example, to an especially heavy ice or wind load. On an ice-loaded line some spans may be cleared of the ice while the others remain loaded or a wire or an insulator in a particular span may break. In order to develop a general solution for this situation, the author has analyzed mathematically the characteristic curves representing the condition of successive wire spans, the relation between the deflection of the insulator and the change in the length of the span of the wire portion of successive wire spans, boundary conditions, determination of the deflections of insulators, law of change in the deflections of insulators, and a practical method of drawing the characteristic lines. The breaking of a wire in a span of continuous wire spans has been given special consideration, as has the partial change in load on continuous wire spans. The failure of a suspension insulator has been subjected to a similar analysis. The discussion, while largely mathematical, is by no means to be considered of a purely theoretical nature.—*Memoirs of the Ryojun College of Engineering (South Manchuria)*, Vol. II, No. 2, 1929.

Portable Mercury-Arc Rectifier Substation.—J. N. Lightbody.—What is said to be the first portable mercury-arc rectifier substation has been completed and placed in service by the city of Calgary to supply direct current to the municipal street railway system. The entire equipment is mounted on a trail car and is completely inclosed except for the transformer. The station is supplied from 12,000-volt, three-phase lines and an air-break switch is mounted on the last pole. The lines from the air-break switch enter the high-tension switch house through wall bushings. Various details of the installation have been included in this article. Special precautions are necessary when the car is in transit in order to prevent damage to equipment. Interference has been taken care of by means of electrostatic filtering equipment consisting of a series reactor in the ground lead from the main transformer and four shunt reactors with condensers of the proper capacity connected across the line to eliminate the harmonics which rectifiers produce. The switchboard is completely automatic. The severe climatic conditions encountered in the winter time also require unusual precautions to insure continuity of service.—*Electrical News and Engineering (Canada)*, September 1, 1929.

Miscellaneous

Biological Effect of Short-Wave Transmission. — K. Heinrich. — With the growing use of long-distance short-wave radio transmission, reports became frequent of certain biological effects of such waves upon the human organism; in some instances the health of the operator was noticeably affected. The author made systematic tests on a rather limited scale with a transmitter for 2 to 44 m. wave length, using small insects, lizards and mice as test objects, and found that the magnetic field had no noticeable effect of any kind. The electric field killed the insects in three seconds, the mice in twenty seconds. Electric radiation was then measured with alcohol thermometers and with thermocouples.—*Elektrotechnische Zeitschrift*, July 25, 1929.

News of the Industry

Birkenhead Has Come to Study Utility Operation

Head of British Power Companies to Consult with American Associates Upon the Problems of the Electrical Industry in Great Britain

ARRIVING in New York on Tuesday of this week for the purpose of further study of the operation and management of American public utilities and to obtain further assistance from his American associates in solving the problems of the electric power industry in Great Britain, the Earl of Birkenhead, who is chairman of the Greater London & Counties Trust, Ltd., British affiliate of the Utilities Power & Light Corporation, and is by virtue of this office at the head of important power companies serving a considerable part of England, gave out an interview in which he said:

Most of my countrymen have noted with interest the great industrial development of the United States and its consequent prosperity. Industrial development goes hand in hand with the progress of electrical energy. A study of your electric development shows that there has been a progressive decrease in the cost of producing energy, with the natural result that the prices paid by the consumer have fallen correspondingly.

The causes of the decrease in the United States of production costs seem to an outside student to be various, but undoubtedly the most powerful has been the construction of great electric generating plants at strategic locations capable of enlargement to meet increasing demands for energy. The superpower system, in fact, has enormously extended the area within which energy is distributable and rendered possible the interchange of facilities with other power stations.

My countrymen have also noted the increasing uses to which electrical energy is being put in the home and on the farm. In Great Britain the use of electrical energy is much less per capita than in the United States and the energy is not produced or sold so cheaply as here. We have been alive to the importance of the problem and are endeavoring to solve it as it is apparently being solved in the United States. A cheap and abundant supply of electricity is our aim. We feel that this will have a beneficent effect upon British industry and tend to alleviate the unemployment problem and place Great Britain in a better position to compete in the markets of the world.

I accepted the chairmanship of the Greater London & Counties Trust, Ltd., which is controlled by the Clarke interests here through the Utilities Power & Light Corporation, and am devoting time and thought to its interests in order to encourage the policy which I believe will greatly aid our industrial progress. The Greater London & Counties Trust controls, through ownership of share capital, a number of operating companies in Great Britain which furnish electricity in areas aggregating over 10,000 square miles, with a population in excess of 3,250,000, including three large areas adjoining the city of London. With the increase in the use of electricity in England, which I believe is proceeding at a rate greater than in the United States, and the decrease in production costs which should follow, British industry should go rapidly forward.

Tenney to Start Salem Plant Next Year

Plans have been announced by Charles H. Tenney & Company, Boston, for the construction in 1930-31 of a 180,000-kw. steam generating plant on tidewater at Salem, Mass., to serve the territory occupied by the subsidiaries of the North Boston Lighting Properties. It is expected that the initial installation will consist of two 60,000-kw. units, a boiler plant to be operated at 450 lb. and a coal-handling installation whose nucleus is already one of the most extensive on the Atlantic Coast. The present station of these interests at Salem has about reached the limit of feasible development.

Extensive improvements in the transmission system of the Eastern Massachusetts Electric Company, through which the various properties between Malden, Cape Ann and the lower Merrimac Valley are interconnected, will form a part of the project. The engineering department of the Tenney organization has been studying this development for several years, pending the decision to undertake field work above indicated.

Electrification for Detroit

Grand Trunk Railroad Plans to Use Multiple-Unit Cars on 26-Mile Stretch of Track to Pontiac, Mich.

PLANS for the electrification of the Grand Trunk Railroad between Detroit and Pontiac, Mich., were announced this week by C. G. Bowker, general manager of Grand Trunk Western lines of the Canadian National Railways System. Mr. Bowker's announcement was made on his return from Montreal, where the plans for the proposed development were laid before Sir Henry W. Thornton, chairman and president of the Canadian National Railways, by whom they were approved.

Multiple-unit electric cars will be used similar to those in use by the Illinois Central Railroad at Chicago and the Pennsylvania Railroad at Philadelphia. Included in the plans are the erection of a terminal and office building on Jefferson Avenue, Detroit, and the construction over the electrified lines of a motor speedway from Detroit to Pontiac, which are 26 miles apart.

The ultimate cost of the terminals and speedway development is put at $100,000,000 and an immediate outlay of $25,000,000 is proposed. Work will start at the beginning of the coming year and plans call for completion of the project some time during 1931.

Truce in Trade Commission Suit Ends

That Body and Electric Bond & Share Both Ask for Master to Determine Whether Company Does Interstate Business—More Delving Into Utility "Propaganda" Expected

AT THE ending of a few weeks' truce between the Federal Trade Commission and the Electric Bond & Share Company on Monday of this week, both parties moved immediately to continue their lawsuit, which promises to become a milestone in the relations between the government and corporate enterprise. For the litigation to carry through, rather than for either side to rest on the preliminary ruling which has been laid down, is the only thing that could have happened. Since the final decision may become an important link in the rights of government to probe the internal affairs of holding and management companies, the outlook from the start has been that the suit would follow from appeal to appeal by the devious channels of legal procedure perhaps as far as the Supreme Court of the United States. Thus the most recent step is generally regarded as a link in a very long chain the end of which is not yet in sight.

It will be remembered that the trouble started when company officers refused to testify or to yield account books last fall in the commission's public utility investigation. The first phase of the suit in the United States District Court, New York City, led to a ruling by Judge Knox that the commission could question witnesses but could not seize the books without showing just cause for belief that such records would show some violation on which the commission is empowered to act. This decision was based on the assumption that the respondent firm is engaged in interstate commerce. If this seemed subject to any legal doubt, Federal Judge

Knox said that he would appoint a master to take evidence toward a further decision.

Both parties signed a stipulation last Monday asking that this be done on or before the first of November. It was further agreed that the death of A. E. Smith, controller and assistant secretary of the Bond & Share company, would have no effect on the action, but that E. P. Summerson, secretary of the company, should be subject to the commission's order, he being the present custodian of the records in question.

No announcement has yet been made concerning the next move in the commission's power probe, but it is expected that the cleaning up of a few more details in the propaganda phase is the next order of business and soon will follow. The long-delayed rebuttal of counsel for the utilities should come some time during the fall. The Bond & Share case presumably will be of such long duration that other matters are likely to continue independently, though delayed by the tying up of the commission's personnel.

Niagara-Hudson Buys Frontier

Acquisition of Applicant for St. Lawrence Site Revives Discussion of Political Aspects of Utility Merger—Lamont Denies Any Bankers' Bias for Private Ownership

PURCHASE by the Niagara-Hudson Power Corporation of the Frontier Corporation, in addition to agreement to acquire the St. Lawrence Securities Company, controlled by the Aluminum Company of America—both made public last Saturday—is a long step toward consolidation in the hands of the organization first named of all important power systems, actual or prospective, in upstate New York. With plans understood to be in contemplation for the building of 110-kv. transmission lines to connect these upstate systems with the metropolitan district, the advantages of unification and interconnection are in a fair way to be intensified over the whole state—both in the neighborhood of the large cities and in the less thickly settled parts. Transmission projects, however, are only in the paper stage.

It will be remembered that the Niagara-Hudson Power Corporation, with assets put at $450,000,000, was formed last June by the union under J. P. Morgan auspices of the Buffalo, Niagara & Eastern Power Corporation, the Northeastern Power Corporation and the Mohawk-Hudson Power Corporation. It brought under one direction a majority of the larger light and power companies north of Westchester County, including those serving Buffalo, Niagara Falls, Syracuse, Utica, Albany, Troy, Amsterdam, Schenectady, Cohoes, Oswego, Watertown and scores of smaller places. The next largest system upstate is that of the Associated Gas & Electric Company, which now controls at Rochester, Binghamton, Elmira and many communities of less size.

The Frontier Corporation, owned jointly by the General Electric Company, the Aluminum Company of America and the Du Pont interests, was the leading applicant in 1926 for a license from the New York State Water Power Commission to develop the Barnhart Island site on the St. Lawrence River according to plans developed by Hugh L. Cooper. Its application, which was apparently on the eve of being granted, was withdrawn in December of that year just before the commission's abolishment and supersession by another body over whose actions the Governor has a veto. The strenuous opposition to the license that came from Governor Alfred E. Smith, then in office, was supposed to have led to the withdrawal of the application, although the Governor could not have overruled the old commission.

Subsidiaries of the St. Lawrence Securities Company, whose reported absorption by the Niagara-Hudson had already been noted in the ELECTRICAL WORLD, are the St. Lawrence Valley Power Corporation, St. Lawrence County Utilities and Antwerp Light & Power Company, all of Potsdam, N. Y. Besides Potsdam and Antwerp, they serve Canton, Gouverneur, Massena, Norwood, Ogdensburg and other small communities, and they own half a dozen hydro-electric plants with a total capacity of 65,700 hp. With their acquisition little utility-owned water power is left in New York State outside Niagara-Hudson Power Corporation territory.

POLITICAL COMPLICATIONS

The extensive utility holdings of the Morgan interests in other states than New York and the various interconnections between different groups of operating companies along the Atlantic Coast lend additional interest to the transactions just noted, which will be hailed on the one hand as an industrial achievement bound to prove itself in the public interest and condemned on the other as another indication of the existence and rapid growth of a power trust. With the old alignment of political parties in New York State on the hydro-electric issue still apparently in existence and with the clear indications that Governor Roosevelt shares his predecessor's views, the question is bound to figure in coming political battles in that state and to have repercussions at Washington as well. None the less, the transfer of the Frontier Corporation and the St. Lawrence Valley utilities may well be viewed merely as further evidence of friendly understanding between the two banking-utility organizations known as "Morgan" and "Mellon" and as exemplifying a policy shared by them of regrouping their subsidiaries, irrespective of which interest has previously controlled them, in such a way as to conduce to increased efficiency in management.

Governor Roosevelt has already come out with a declaration that leaves no doubt of his attitude. Pointing out that it presents a false picture of the situation to intimate that the Frontier Corporation needs only a state permit to begin development and asserting that it owns none of the riverbed or the water flowing over it and could do nothing without a riparian lease from the state, and also that there are three other factors of great importance—the federal government's interest in navigation, the Dominion of Canada's interest in navigation and the interest of the Province of Ontario in its half of the potential power, the Governor says:

> The very simple question still remains the same after this new merger. It is the question of whether the site shall be developed by a private power company after the state has given it a long-term—virtually a perpetual—lease of the state property or whether the state itself shall create public trustees to build the dam on the state's property, put in a power house and sell the electricity in such manner as will guarantee to the private citizens who consume the power the lowest possible cost in their homes and industries . . . It goes almost without saying that I shall again ask the Legislature to create a body of public trustees to undertake the St. Lawrence development by and for the people of this state. The recent concentration of ownership of hydro-electric light and power companies into one private ownership covering about 80 per cent of the area of the whole state makes this policy of state development of the one remaining great source of electric supply more and more imperative.

From Washington Senator Walsh of Montana, to whom was due the utility investigation now under way by the Federal Trade Commission, is reported as saying:

"The story printed of further mergers of power properties in which the Morgan and Mellon interests figure indicates another long step in the direction of unified control of the power possibilities of the nation, a movement to which the general public seems to be not only indifferent but apathetic. It is an ominous tale as well to the forty million people marketing their products through the ports of the Great Lakes and who look for speedy development of the St. Lawrence route to the sea."

Senator Walsh, however, denies reports that he plans to introduce a resolution in the Senate asking for an investigation of the matter. Senator Capper of Kansas has declared for a Senate investigation of power-company mergers, expressing fear that the proposed Lakes-to-Gulf waterway, of which he is a leading advocate, will be prevented by "New York power magnates." Senator Wagner of New York backs Governor Roosevelt unreservedly.

NIAGARA-HUDSON ISSUES STATEMENT

In a statement issued on Tuesday by Floyd L. Carlisle, chairman, and Roy P. Stevens, president of the Niagara-Hudson Power Corporation, it is denied

that the Niagara-Hudson "has adopted any particular policy or has any definite plans regarding the development of the St. Lawrence." The statement briefly traces the origin of Niagara-Hudson, agrees with Governor Roosevelt's assertion that nothing in the existing status has been changed by the sale of the Frontier Corporation and emphasizes the point that any proper power development will aid, not hinder, navigation. It concludes thus:

If electrical energy can, on a sound economic basis, be created from rights owned by the state or federal government that will cheapen the cost of light and energy to the consuming public, we are heartily in favor of this being done as quickly as possible, and we pledge ourselves to assist and co-operate to that end in whatever practical manner may be found to be in the best interest of all concerned.

In the discussions leading up to the organization of the Niagara-Hudson Power Corporation and in the consideration of its later acquisitions no question has been deemed more important than the possibility, through unified ownership, of distributing and delivering electrical energy more cheaply than under the former conditions of diversified ownership and operation.

Niagara-Hudson fully recognizes its trusteeship to the consumer and to the public; without this recognition the corporation's obligations to its own stockholders cannot be fulfilled.

BANKERS' OPEN MIND

On the same day Thomas W. Lamont, of J. P. Morgan & Company, said to newspaper men that neither that firm nor, so far as he knew, any of its associates had taken any position for or against public or private ownership of the St. Lawrence River water power. "In our opinion," Mr. Lamont said, "these are matters for the determination of the government of the United States and the government of the State of New York and by the Canadian authorities. In so far as we have any opinion in the matter it is our belief that, speaking generally, these power companies are abstaining and should continue to abstain from intervention in the decision of this question and should loyally cooperate with the decision of the public authorities when that decision has been arrived at."

Samuel Untermyer, who was legal adviser to Governor Smith in 1926 on questions connected with St. Lawrence development and who favors the state's building transmission lines as well as generating stations, declared Mr. Lamont's declaration to be "most surprising and gratifying" and "almost too good to be true—so good that we must not relax our vigilance."

Program of Utilities Sessions of Safety Council

At Chicago on September 30 to October 4 the eighteenth annual congress of the National Safety Council will be held. The Public Utilities Section will hold sessions on Tuesday, Wednesday and Thursday, and among the events will be demonstrations and awards in connection with prone-pressure resuscitation, an address on "Thinking in Terms of Safety," by D. D. Fennell; "Protection of the Public," a symposium in which W. Briley Wright of the Eastern Shore Public Service Company will speak for the electric utilities; a discussion of accident-prevention developments in a public utility, awards to the winners in this year's contest in the avoidance of accidents, a talk by Dr. Harry Myers of the Frigidaire Corporation, Dayton, Ohio, on "What Is the Best Safety Device?" and an illustrated discourse on pole handling by C. S. Holloway of the Illinois Bell Telephone Company. "Safety and Economics" will be the theme of E. C. Stone of the Duquesne Light Company, who as manager of system development for that organization has acquired a broad viewpoint on his topic.

Purchases and Mergers

Dame Rumor Works Overtime—Dixie Power Company Goes to Foshay, Snow Mountain Company to Pacific Gas—Middle West Transfers

PURCHASE by the Niagara-Hudson Corporation of the Frontier Corporation, former applicant for a license to build a power plant on the St. Lawrence River in New York State, is reported fully on another page, with mention of the confirmation of the previously reported acquisition by the Niagara-Hudson of the St. Lawrence Valley Power Corporation plants, formerly controlled by the Aluminum Company of America. An offer by the Public Utility Holding Corporation of America for the Pacific Lighting Corporation of San Francisco —this offer being opposed by the executive vice-president of the latter and not certain of acceptance—revived newspaper reports of a coming consolidation of the Los Angeles Gas & Electric Corporation (owned by the Pacific Lighting), the Southern California Edison Company and the Pacific Gas & Electric Company, but these reports, like numerous similar conjectures affecting large operating companies in various parts of the country, are still in the category of rumor and likely to remain there with the familiar label "important if true." Announcements of smaller transactions, true if not so important, continue plentiful.

Controlling interest in the Dixie Power Company, which serves eighteen communities in Washington and Iron Counties, Utah, with electric power, has been sold to the W. B. Foshay Company, according to an announcement made by Lafayette Hanchett of Salt Lake City, a former large shareholder. The estimated value of the Dixie Power Company is approximately $1,500,000. The purchase includes four hydro-electric generating plants, one Diesel-engine generating plant and approximately fifty miles of transmission lines. Power lines of the Foshay company in Arizona are less than 100 miles from the lines of the Dixie Power Company.

Subject to the approval of the California Railroad Commission, the Pacific Gas & Electric Company will acquire the common and preferred stocks of the Snow Mountain Water & Power Company in exchange for Pacific Gas & Electric common shares. The Snow Mountain company owns a hydro-electric generating and transmission system in Mendicino, Sonoma and Napa Counties. Its generating plant on the Eel River at Potter Valley has an installed capacity of approximately 12,000 hp.

Authority has been given by the Ohio Public Utilities Commission to the Ohio Electric Power Company of Sidney to sell its plant at Union City, Ohio, to the newly formed Union City Electric Company, of Lima and Union City, for 520 shares of no-par common stock of the new corporation.

An offer from the Iowa Railway & Light Corporation, Cedar Rapids, to take over the municipal electric plant in Glidden, Iowa, was rejected last week by five to one by the voters. The corporation offered $50,000 for the property.

The People's Gas & Electric Company, Mason City, Iowa, has about completed negotiations to take over the Clear Lake (Iowa) lighting plant from the Central West Public Service Company, Omaha, which acquired it six months ago. Certain People's Gas & Electric properties in the southern part of the state will be transferred in exchange for the Clear Lake property.

An offer of $110,000 has been made to South Sioux City, Neb., for its municipal electric light plant by W. J. Bertke, president of the Sioux City (Iowa) Gas & Electric Company, and if it is accepted the Nebraska properties may eventually be combined with the Sioux City utility. A year ago South Sioux City rejected an offer for purchase of the property at a lower figure. An election will probably be held.

The Missouri Public Service Commission has authorized the Missouri Power & Light Company to purchase and operate the electric distribution system of the Lathrop Light, Heat & Power Company for $33,000.

The Montana-Dakota Power Company has purchased the electric light plant at Camp Crook, S. D.

The North Dakota Power & Light Company has purchased the electric property at Center, N. D., from the Center Light Company.

A proposal to sell the city electrical distribution system of Williston, N. D., to the Montana-Dakota Power Company for $125,000 has been approved in a special election by a vote of 849 to 517.

The New York Central Electric Corporation has purchased the Woodhull Electric Light Company, formerly owned and managed by Elmer and Arthur Hackett and serving more than 75 consumers.

The New York Central Electric Corporation has petitioned the Public Service Commission for consent to transfer its franchises and plant at Perry, N. Y., to the New York State Electric Corporation of Ithaca. The Perry company's properties are interconnected with the properties of the Elmira Water, Light & Railroad Company, which is also seeking consent to transfer its franchises and system to the New York State Electric Corporation.

George L. Ohrstrom, president of the Tri-Utilities Corporation, a large holder of electric, gas and water securities, announces that his company has increased its holdings in the People's Light & Power Corporation, which controls electric plants in Oregon, Minnesota, Wisconsin, West Virginia and Texas. The Tri-Utilities now owns all the class B common stock of the People's Light & Power.

New Electrical Tests of Rails and Welds

Cleveland Meeting of American Welding Society Notable for Revelation of Novel Non-Destructive Testing Methods—Many Valuable Papers

SIXTEEN technical papers, presented in six sessions at the fall meeting of the American Welding Society, held at Cleveland on September 10 to 13, proved a valuable contribution to the art of welding. Simultaneously the National Metal Exposition was in progress at the Public Auditorium under the joint auspices of the American Welding Society and the Society for Heat Treating. About 300 delegates attended the meetings of the society, which were notable for the extent of the research and testing activities covered and especially for their revelations of new non-destructive tests by electrical means.

Elmer A. Sperry was the author of one of the papers on non-destructive tests. He described a method developed by him by which 20,000 rails a day can be examined electrically for internal transverse fissures. The Sperry rail tester is housed in a car that proceeds along the track at a fair speed. By purely electrical means it plots continuous curves on paper, giving a precise picture of the internal uniformity of the rail, inch by inch, so that the location and extent of flaws are precisely indicated. More than that, the flaws are automatically "tagged" by the spraying of paint on each defective point in the rail as the car passes along.

A paper by A. B. Kinzel, C. O. Burgess and A. R. Lytle, all of the Union Carbide & Carbon research laboratory, told how the authors have devised and developed methods of non-destructive testing of welds applicable to plates, pressure vessels, pipe joints and structural steel joints. The method consists essentially of first detecting by means of a stethoscope the presence of any spots in the weld that are different in character from the satisfactory weld, and, second, in obtaining special X-ray photographs of these spots, to determine the seriousness of the deviation from normal.

H. G. Reist, of the General Electric Company, in a paper on the effect of design on the use of welding in the manufacture of electric machinery, stressed the importance of designers of welded machines forgetting preconceived notions of shape and proportion based on experience of past construction.

Special difficulties in the welding of copper and high-copper alloys, their causes and the methods of overcoming them, were discussed in detail by Ira T. Hook, testing engineer of the American Brass Company.

Other contributions covered welding from the angle of the chemist and metallurgist, misconceptions of carbon-arc welding, metallic arc welds, X-ray tests at the Watertown (N. Y.) Arsenal, stresses in fillet welds, foreign practice in welding boiler tubes and drums, automatic arc welding of thin sheets, laying welded-pipe lines in open country, electric welding of field joints, and welding of tubes and pipes for locomotives and boilers.

Home Wiring Needed

Major Bennion's Discussion of Its Importance to the Electrical Industry —All Safe Methods Welcome, He Says

INTEREST of the electrical industry in securing a generous increase in home wiring at lower prices was explained by Major H. S. Bennion, director of engineering of the N.E.L.A., in an address which was one of the leading features of the convention of the Northwest Section of the International Association of Electrical Inspectors held at Vancouver, British Columbia, on September 11. The unlimited use of long portable cables and floor-lamp cords and the pennied fuses are both positive indications of a need for expansion of house-wiring systems, for more circuits, heavier circuits and more outlets, he said; but the more expensive forms of wiring now in use will not lend themselves to this enlargement. Central-station executives "hope for the installation of every foot of rigid conduit that the traffic will bear and all the armored cable and metal surface raceway as well. In addition, they desire to promote free use of all other systems of wiring, those that are known as well as those that have yet to be developed, upon the single condition that they comply with the indispensable provisions for safety." Later in the address Major Bennion intimated that he looked for the early advent of new, simpler and probably cheaper wiring methods.

In discussing the hazard to life of voltages below 150 Major Bennion reported that the N.E.L.A. was making a thorough investigation of this subject. While not completed, it did justify the statement that the rate for authenticated fatalities at less than 150 volts to ground will be found to be somewhere between one-half and three-quarters of a fatality per million inhabitants per annum, excluding the few cases of public utility employees working on public utility plants. Most of these accidents were the result of tinkering and doing unpredictable things which no reasonable code could guard against. In fact, with the "bathtub" and "boiler" and other "non-code" cases omitted, there are about five to ten cases each year in this country which could be prevented by code provisions if all the attendant circumstances could be known in advance. These data, if confirmed, serve as a splendid testimonial to the art of house wiring. "Under these circumstances does it not appear a little absurd," Major Bennion asked, "to denounce systems showing a modest departure from some of the conventional ideas as a breakdown of indispensable code standards?"

The address ended with a plea to the inspectors to keep an open mind to new methods and proposed modifications.

President Hopes to Attend Dearborn Celebration

Twenty-seven States to Participate in Jubilee Officially Through Governors' Messages—Ohio, Michigan and New Jersey Stress Relation to Edison

TENTATIVE travel plans made by President Hoover will, press dispatches say, bring him to Detroit on October 21 in time to address the culminating celebration of "Light's Golden Jubilee" to be held at Dearborn under the auspices of Henry Ford and at which Mr. Edison, reported to be rapidly recovering from his recent serious illness, is expected to be present.

Announcement comes from 27 states so far that an official character will be given to the celebration by Governor's proclamation or message. These states are Arizona, Arkansas, California, Florida, Idaho, Illinois, Indiana, Kentucky, Maine, Maryland, Massachusetts, Michigan, Nevada, New Hampshire, New Jersey, New Mexico, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, Tennessee, Texas, Utah, Wisconsin and Wyoming. Ohio, where Edison was born; Michigan, where his youth was passed, and New Jersey, where his chief inventions were made, are naturally especially eager to participate in the jubilee, and their respective governors—Myers Y. Cooper, Fred W. Green and Morgan F. Larson—in their official utterances are emphasizing the connection of Edison with their commonwealth.

British Government Inquiry on Main-Line Electrification

The British Minister of Transport announces that the government has had under consideration the advisability of obtaining a report upon the problem of the electrification of the main-line railroad systems of the United Kingdom. A committee has accordingly been appointed, consisting of Lord Weir of Eastwood (chairman), Sir Ralph Wedgwood and Sir William McLintock. The secretary will be Colonel A. H. C. Trench of the Ministry of Transport.

The appointment of this committee will in no way interfere with or delay any particular schemes of suburban or other electrification which may be otherwise under consideration. Lord Weir presided over the committee which was appointed in 1925 to review the national problem of the supply of electrical energy, whose report led to the electricity (supply) act of 1926, and the establishment of the Central Electricity Board, responsible for the great regional power distribution project. Sir Ralph Wedgwood is the general manager of the London & North Eastern Railway, and Sir William McLintock, who has advised the government on many matters, was appointed by the Transport Ministry to be the auditor of the Central Electricity Board. Colonel Trench is an inspecting officer of railways under the Transport Ministry.

Canada Adds 200,000 Hp.

Government Review Gives This Figure for First Half of Year — Projects Under Way with Ultimate Rating of 2,000,000 Hp.

ACCORDING to the midyear review of water-power activities in Canada recently issued by the Department of the Interior at Ottawa, new developments together with additions to existing plants have added almost 200,000 hp. to the total installation in the Dominion since the beginning of the year, while undertakings are under way which when completed to their designed capacities will involve a total installation in excess of 2,000,000 hp.

The Ontario Hydro-Electric Power Commission has under way the addition to its Queenston station on the Niagara River of the tenth unit of 58,000 hp. rating. Work has also been resumed on the 54,000-hp. plant at Alexander Landing, on the Nipigon River, which will be completed in 1931. Two small plants, one of 1,800 hp. at Elliott Chute on the South River near North Bay and one of 2,200 hp. at Tretheway Falls on the South Muskoka River, are almost completed. In northern Ontario there are two new developments—one of 28,200 hp. for the International Nickel Company of Canada at Big Eddy Dam, on the Spanish River, and the other for the Algoma District Power Company at High Falls on the Michipicoten River. The latter has an initial installation of 18,770 hp., the power being delivered by a newly constructed transmission line to Sault Ste. Marie. A development of 13,000 hp. capacity is in immediate prospect for the Canada Northern Power Corporation at the Upper Notch on the Montreal River.

Installations already completed during the present year in Quebec include the addition of fourth units to the Chelsea and the Farmers' Rapids developments of the Gatineau Power Company, of 34,000 hp. and 24,000 hp. respectively, and the second unit of 25,000 hp. at the company's Bryson development, on the Ottawa River; the addition of unit No. 8 of 34,000 hp. to the Shawinigan Falls development of the Shawinigan Water & Power Company and the completion of the 5,800-hp. plant of the city of Sherbrooke at Westbury on the St. Francis River.

The Alcoa Power Company is making rapid progress with its development on the Saguenay River, which will have an initial installation of four 65,000-hp. units, scheduled for completion in 1931. The ultimate plan is for an installation of 1,000,000 hp.

On the Rivière des Prairies near Montreal the Montreal Island Power Company has work well advanced on a development which will have an initial installation of six 8,800-hp. units and which may be in operation this year. The James Maclaren Company has a development actively under construction at High Falls on the Lievre River which is designed for an initial installation of 90,000 hp. and an ultimate capacity of 120,000 hp.

In British Columbia construction was started early in the year on a development for the British Columbia Power Corporation at Ruskin on the Stave River. It is expected to have the first unit of 42,500 hp. in operation by the autumn of 1930 and a second unit of similar size in 1931. The same corporation is actively proceeding with the construction of a large development on Bridge River, with the expectation of completing the initial installation of 56,000 hp. in 1933. Other developments are under way in Alberta and Saskachewan and the Maritime Provinces.

Claude Neon Firm Fights Transfer of Rights

Decision was reserved in the Supreme Court of New York on September 16 in a suit brought by Claude Neon Lights, Inc., to prevent the sale by the Federal Electric Company of Chicago, controlled by Insull interests, of rights to employ Neon advertising and display lights in Middle and Western states. The would-be purchasers are the Rainbow Light, Inc., and the Rainbow Luminous Products, Inc., heretofore competitors of the Claude Neon Lights. The complaining firm charges a breach of trust by the seller and danger to the plaintiff's trade secrets. A temporary injunction granted last week was continued, the plaintiff filing a bond of $150,000 to indemnify the defendants should the injunction be vacated and damages established.

Electragists Meet at Swampscott September 30

The twenty-ninth annual convention of the Association of Electragists International will convene at Swampscott, Mass., for a four-day meeting beginning September 30. The meeting, which will be attended by approximately 600 electrical contractors and dealers from all sections of the country, is expected to outrank in the scope of its activities any of the kind held previously.

Among the speakers scheduled to address the various meetings are Clyde L. Chamblin of San Francisco, president of the association; Dr. Hugh P. Baker, manager of the trade association department of the Chamber of Commerce of the United States, who will talk on charting the course for trade associations; R. A. Balzari, marketing counselor of the McGraw-Hill Publishing Company, who will discuss the industrial field for motors; John W. Hooley, president of the Electrical Contractors of New York, who has selected for his subject "Stabilizing the Electrical Contracting Business," and J. E. Vaughan, Jr., trade group department, National Association of Credit Men, who will discuss methods of sound business practice through credit control. Methods of credit control, their application to industry in general and suggested improvements are to constitute one of the major phases of discussion.

Flathead River Hearing

Federal Power Commission's Secretary Will Hold One at Washington October 28—More Applications from Pacific Coast for Licenses

QUESTIONS involved in the development of the Flathead River in Montana will be considered at a public hearing in Washington, October 28, before the executive secretary of the Federal Power Commission.

The commission recently announced its intention of acting favorably on the application of the Rocky Mountain Power Company covering this project. That company applied for a preliminary permit in 1920. Because of engineering studies that had to be made the commission was not in a position to act on that application, so the company proceeded without a permit to make its preliminary investigations. When the studies made on behalf of the commission were completed the Rocky Mountain company filed an application for a license.

In 1928 Walter H. Wheeler filed a conflicting application. After study the staff of the commission believes the public interest would be served best by the development of the project by the Rocky Mountain company. Moreover, it has not been convinced that Mr. Wheeler has the financial support necessary to undertake the project. Mr. Wheeler objects to the decision against him and has requested a hearing. One of the points made by Mr. Wheeler is that he will pay more for the use of Indian lands than will the Rocky Mountain company. Evidence in that connection will be taken at the hearing. It is planned also to establish the extent of the damage from new lake levels.

The California-Oregon Power Company has applied to the Federal Power Commission for a license covering a constructed transmission line 47 miles long. The line extends from the California-Oregon company's Fall Creek plant to the Gold Ray power plant in Jackson County, Ore.

J. W. Preston, Jr., of San Francisco, has applied for a license covering a proposed development on the South Fork, Licking Fork and Middle Fork of the Mokelumne River. On the Middle Fork it is proposed to create a reservoir with a capacity of 20,500 acre-feet. Diversion dams are to be built on South Fork and on Licking Fork. The power house will be near the junction of the South and Middle Forks. It is planned to install 15,000 kva. This application is pursuant to a preliminary permit issued July 26, 1926.

W. P. Anderson and R. L. Chase have applied for a license covering a minor project on the North Fork of Trinity River in Trinity County, Calif. The dam is to be 15 ft. high, and the power is to be used in nearby mines.

The Pacific Power & Light Company, Portland, Ore., has applied for a license covering a 19½-mile transmission line to connect the line of the applicant with that of the Inland Light & Power Company in Benton County.

American Committee Dines Delegates to Tokyo

Delegates from European countries on their way to the World Engineering Congress to convene in Tokyo next month attended a dinner given in their honor in New York by the American committee on September 12. Dr. Elmer A. Sperry, chairman of the American committee, presided and introduced Drs. Carl Koettgen, president Verein Ingenieure Deutscher and general director of the Siemens-Schuckert Works; Conrad Matschoss, director Verein Ingenieure Deutscher, and Major H. C. E. Cherry of England, who were the speakers of the evening.

In paying tribute to the engineering development in America in the past few years, Dr. Koettgen evinced a feeling that "Germany has profited and will do so from lessons of teamwork, co-operation and service which have been so notably effective in the United States." The value of membership in engineering societies was particularly stressed by Dr. Koettgen, who added: "Outside of the schools and colleges the institution most deserving of credit for engineering advancement is your technical press." American experiments with and practical use of high-pressure steam for power generation particularly interested Dr. Koettgen, who has done considerable work along this line, present development by his organization involving pressures up to 4,000 lb. per square inch.

Dr. Matschoss praised American engineering advances, particularly in the power field, and invited participation in the second plenary World Power Conference to be held in Berlin next year. Major Cherry told of engineering developments in Burmah. Dr. Koettgen and other European delegates will join in San Francisco the American delegation of 258 engineers who sail to Japan on October 10. The Tokyo Congress will convene October 29.

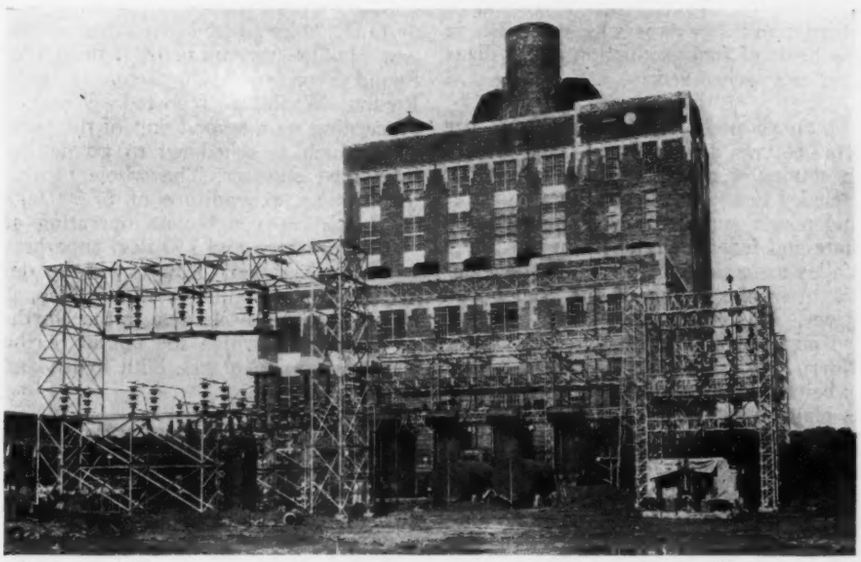
Electric Meter Papers Fill New York Meeting

The auditorium of the New York Edison Company on West Twenty-seventh Street was again the meeting place of the Electric Meter Section of the Empire State Gas and Electric Association on September 12 and 13. Two sessions were held on Thursday and one on Friday. Frank W. Smith, vice-president United Electric Light & Power Company, welcomed the delegates, and Charles S. Ruffner, president of the association, made an address.

Other items on the program were practical papers on the meter department's place in the utility by E. E. Hill, new developments in meters and equipment by D. P. Burleigh, M. A. Zeek, H. Nehls and Scott Lynn; nominal versus actual rating of watt-hour meters by C. V. Morey, service and meter installation practice by W. J. Consler, testing watt-hour meters with the stroboscope by H. P. Sparkes, accident prevention in the meter department by D. M. Thomas, methods of improving efficiency of meter departments by W. L. Carr, and new electric instruments and circuits by B. W. St. Clair. George Roehrig reported on the meter school.

George B. Teevan of the Brooklyn Edison Company was re-elected chairman for the ensuing year. The annual meeting of the association, held at Upper Saranac on Thursday and Friday of this week, will be reported in the next issue of the ELECTRICAL WORLD.

Gorgas Steam Plant No. 2 of Alabama Power



BUILT on the Warrior River, in the Warrior coal fields, Alabama, close to the 70,000-kw. Gorgas steam-electric generating plant No. 1, the second Gorgas steam plant of the Alabama Power Company, just completed, has a present rating of 60,000 kw. and is designed for an ultimate rating of four times as much. It was briefly described on August 31 (page 439).

Briefer News

SOUTHERN SECTION, I.A.E.I., WILL HOLD FIRST MEETING AT ATLANTA.—The new Southern Section of the International Association of Electrical Inspectors will hold its first annual meeting on October 15 to 17 at the Ansley Hotel, Atlanta.

LAMAR, COLO., TO EXTEND MUNICIPAL DISTRIBUTION LINES.—The Colorado Public Utilities Commission has granted permission to the city of Lamar, Colo., to extend its transmission and distribution lines to serve the towns of McClave, Big Bend and Kornman Junction, as well as stations at Wiley, Hartman, Granada, Bristol, May Valley and Millwood.

REFERENDUM ON PROPOSED MUNICIPAL PLANT SOUGHT IN SANDUSKY, OHIO.—A petition for a referendum on a municipal light plant for Sandusky, Ohio, has been filed with the city auditor-treasurer. It bears the signatures of 1,700 citizens, who are said to desire to make what they term "curbing the Ohio Public Service Company" the issue of the fall campaign.

ROCHESTER GAS & ELECTRIC REMOVING OLD STATE DAM.—Work has been begun by the Rochester Gas & Electric Corporation on the removal of the old state Mohawk Dam on the Genesee River at Court Street, Rochester. This dam was originally built as a part of the Barge Canal Harbor. The company's new Court Street dam having proved efficient, the company is, in accordance with its agreement with the state, demolishing the Mohawk structure.

NEW SUBSTATION FOR UNITED ELECTRIC LIGHT OF SPRINGFIELD, MASS.—Plans are being prepared by the United Electric Light Company, Springfield, Mass., for a brick substation to be erected in Converse Street at an estimated cost of $350,000, to be completed in 1930. The substation will take care of street and house lighting and power in the Forest Park district of Springfield.

WESTERN MASSACHUSETTS COMPANIES EXPANDING.—The Pittsfield (Mass.) Electric Company has petitioned the Massachusetts Public Utilities Commission for authority to carry on a public utility business in the towns of Hinsdale, Dalton, Lanesboro, Lee, Richmond and Windsor. The Lee (Mass.) Electric Company has also filed a petition to give electric light service in the towns of Tyringham, Sandisfield and Otis.

HYDRO-ELECTRIC PROJECT FOR SAN DIMAS, DURANGO, MEXICO.—T. L. Worden, a British engineer understood to represent a syndicate of Canadians, has been making a survey for a dam and hydro-electric plant near San

Dimas, in the Mexican State of Durango. The plans call for an initial capacity of 50,000 hp. and an expenditure of approximately $5,000,000. Mr. Worden says that transmission lines will be constructed to Durango, Mazatlan and other towns and mining districts within a distance of 200 miles.

LAKEVIEW (ORE.) PLANT TO BE ENLARGED.—The California Public Service Corporation has perfected plans for increasing the capacity of its electric plant in Lakeview, Ore., which will necessitate an expenditure of $100,000. In addition to the construction of a new power house, the company will install Diesel generating units.

DATE FOR VALUATION HEARING ON PORTLAND (ORE.) ELECTRIC POWER COMPANY SET.—The Oregon Public Service Commission will hold a public hearing in Portland on October 15 in regard to the valuation and rates of the Portland Electric Power Company. The commission has been collecting data for this hearing since January.

WESTINGHOUSE LIGHTING INSTITUTE OFFERS ANOTHER COURSE.—A fundamental course in general and decorative home lighting will be offered by the Westinghouse Lighting Institute on October 7, 8 and 9 at the Grand Central Palace, New York City. This course is designed for men and women who are interested in producing unusual and attractive effects in home lighting and will embody a series of talks and a comprehensive inspection tour supplementing the lectures.

HYDRO-ELECTRIC SURVEYS FOR VIRGINIA RIVERS.—Organization for the power survey of the James River to be conducted by the United States War Department is under way according to Colonel Henry M. Jewett, district engineer at Norfolk, and a crew of 25 men will be put into the field some time during the present month. The War Department has set aside $145,000 for a similar survey of the Roanoke and Meherrin Rivers and their tributaries. No special sum has been authorized for the James River study, but the district engineer estimates that it will cost more than $80,000.

CITY ATTORNEY OF ANDERSON, IND., SAYS FUNDS OF CITY PLANT MAY BE INVESTED IN CITY SECURITIES.—A ruling recently made by the city attorney of Anderson, Ind., will be of wide importance to utilities in Indiana if it is accepted elsewhere and not overthrown by the courts. Arthur Beckman, the city attorney, has ruled that there is nothing in the Indiana statutes to prevent the use of money in the depreciation reserve fund of municipally owned utilities for the purchase of bonds issued against the general fund of the city and that the board of works may authorize the investment of the sinking funds and any surplus funds of either the electric or other municipal plant in Anderson municipal bonds. "The foregoing opinion holds good with reference to the investment of such funds in time warrants of the city of Anderson," the attorney says.

ALABAMA'S "TRI-CITIES" DEBATING MUNICIPAL DISTRIBUTION.—Sheffield, Florence and Tuscumbia, in northwestern Alabama, known in that state as the "Tri-Cities," are undergoing an agitation for a municipal electric distribution system, and if 500 signatures can be obtained in Florence, a petition advocating such a step will be presented to the City Commission there. The plan is apparently to purchase energy directly from the government plant at Muscle Shoals, not far away.

N.E.L.A. COMMITTEE MEETINGS NEXT WEEK.—The executive committee of the Accounting National Section, N.E.L.A., will meet at the Palmer House, Chicago, on September 23: the executive committee of the Public Relations Section at the Edison Building, Chicago, on September 24, and the national executive committee at the Edison Building on September 25. Engineering Section committees will meet at the William Penn Hotel, Pittsburgh, on September 30 and October 1 to 3, the executive committee of that section convening on October 1.

THIRD NATIONAL FUELS MEETING TO BE HELD AT PHILADELPHIA OCTOBER 7-9.—Training the fuel engineer, pulverized coal, stoker design, economics of industrial heating, electricity for industrial heating furnaces, low-temperature carbonization, water-cooled furnaces and smoke abatement will be among the topics dealt with at the third national fuels meeting, which will be held under the auspices of the Fuel Division of the American Society of Mechanical Engineers at the Bellevue-Stratford Hotel, Philadelphia, on October 7, 8 and 9. More than thirty papers by specialists in the fields of fuel production and utilization are scheduled.

IRRIGATION-PLUS-POWER PLAN FOR REPUBLICAN RIVER, NEB.—Land owners in southwestern Nebraska who are not included in any of the combination water and power surveys now being made by state and federal engineers in the Platte Valley are agitating for similar developments in the valley of the Republican River. Meetings have been held at various towns interested, and Senator Norris, whose home is in the valley, is being asked to aid the project, which is planned to irrigate 200,000 acres between Franklin and the Colorado line, as well as supply power to towns and rural districts.

MCKENZIE, TENN., SEEKS TO REGAIN POWER PLANT.—Charging that the Kentucky-Tennessee Power & Light Company purposely suppressed information as to reasonable market values in the sale of the McKenzie (Tenn.) power and water plant in 1926, and that the price received was inadequate, the city of McKenzie has filed suit in the federal court seeking return of the plant with profits which have accrued since the sale was consummated. The price paid by the company was $79,000. The city now claims that the plant was worth twice that sum. By the terms of the sale the company acquired a 25-year franchise.

RED WING, MINN., WANTS TO GENERATE POWER AT GOVERNMENT DAMS.—Use of the new dam at Hastings, Minn., for power-plant purposes by the city of Red Wing might affect sewage disposal in Minneapolis and St. Paul, representatives of the Metropolitan Drainage Commission objected at a hearing on the power project before Colonel W. F. Willing recently, but eventually all of those in attendance approved the project. The Red Wing plan is to develop 3,600 kw. immediately upon completion of the dam, with an ultimate development of 6,000 kw. That city is prepared to issue $1,279,000 in bonds to finance the power plant.

MAKING A POWER-HOUSE SETTING ATTRACTIVE.—Landscaping of the grounds surrounding the Spokane Falls in the heart of Spokane, Wash., as a memorial park to the late William Augustus White of New York, for many years chairman of the board of the Washington Water Power Company, will be undertaken at once, according to the announcement of his son. The project calls for planting lawns, shrubs and trees to restore the setting of the falls as it was forty years ago. Promenade walks will be laid so that all may view the falls and, below them, the Monroe Street power station of the Washington Water Power Company.

FIRST UNIT OF SHUFFLETON STEAM PLANT COMPLETED.—Completion of the first 37,500-kw. turbo-generator at the new Shuffleton steam plant of the Puget Sound Power & Light Company, near Renton, Wash., is reported. Work is proceeding on a second unit of the same size, which is scheduled to go on the lines next summer. The whole project involves an expenditure of $7,000,000. Two Stirling-type boilers operating at 450 lb. pressure and 750 deg. superheat will supply steam. Power will be delivered to a switching station which, it is said, will be the largest in the Northwest and into which the output of the company's main plants, both hydro and steam, will flow.

STEAM PLANT ON DEVIL'S RIVER, TEX., PROGRESSING TOWARD COMPLETION.—Contruction work has started and rapid progress is being made on the Devil's River steam generating station of the Central Power & Light Company near Del Rio, Tex. Fifty-two caissons have been sunk through 18 ft. of gravel to solid rock, and pump pits, condenser pits and basement floor are completed; basement-floor walls are

nearly completed, and the excavation for intake and discharge tunnels is nearly finished. The station will consist of two 7,500-kw. turbo-generators and three boilers, with necessary auxiliaries. Provisions will be made for expanison to about 50,000 kw. The company has also two hydro plants in operation on Devil's River.

APPLICATIONS FOR BOULDER DAM POWER MUST BE FILED BY OCTOBER 1.—The Department of the Interior has sent out notices to all prospective purchasers of power to be generated at Boulder Dam that their applications for such power must be filed with the department in Washington not later than October 1.

CENTRAL ILLINOIS PUBLIC SERVICE TO BUILD FIFTEEN-STORY OFFICE BUILDING IN SPRINGFIELD, ILL.—Announcement has been made that a fifteen-story office building will be erected at Springfield, Ill., by the Central Illinois Public Service Company. Razing of the buildings now on the site will commence about November 1, and the new building is expected to be completed about January 1, 1931. It will be in the heart of the city, with a frontage of 88 ft. on Sixth Street and a depth of 145 ft. on Adams Street. The Utility structure will be built of Bedford stone and will be the largest office building in the city. Headquarters for the company, which will occupy a large portion of the structure, will be there.

CENTRALIA, WASH., AGAIN TO VOTE ON MUNICIPAL HYDRO PROJECT.—At a special election to be held on September 30 the voters of Centralia, Wash., will be asked to approve for the second time plans for a million-dollar municipal power project on the Nisqually River. The special election was ordered by the City Council following the action of the State Supreme Court, which on August 24 issued an injunction restraining the city from proceeding with the project, on the ground that notice of election had not been published in the city's official newspaper the requisite number of times. The suit, which was brought by a Centralia taxpayer, was carried to the Supreme Court after the Lewis County Superior Court had dismissed it.

EARLY MORNING ACCIDENT SHOWS ST. LOUIS CUSTOMERS VALUE OF ELECTRICITY.—When a disconnecting switch blew out at the Cahokia power plant of the Union Electric Light & Power Company of St. Louis at 4:30 a. m. on September 11 five turbines were put out of service and a district 50 miles south and west and 100 miles east of St. Louis was affected in greater or less degree. There were no lights for several hours in a large part of the city, "stop-and-go" traffic signals were put out of commission and domestic electric motors stopped, as did clocks run by a time service furnished by the power company. At 9 a. m. two of turbines were back in service, the others three hours later.

ITEMS FROM BRITISH COLUMBIA.—The British Columbia Electric Railway Company is seeking permission to divert an additional 300 sec.-ft. of water from Alouette Lake, whence water is conveyed to the company's automatic generating plant on Stave Lake.——Work on the Falls River power development of the Northern British Columbia Power Company, near Prince Rupert, will begin about three months after the granting of its application, according to L. C. Jacobs, construction engineer. The power house will be built about 500 ft. above the fork of the falls and the Ecstall River and will be connected with a dam 750 ft. distant by steel penstocks. The initial head will be 200 ft., and four units, with a total capacity of 30,000 hp., will be installed.——Permission has been refused to the Duncan Utilities, Inc., to build a power line to serve the Cobble Hill and Shawnigan Lake portion of Vancouver Island, the British Columbia Electric Railway Company having obtained the right to build such a line.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue of July 6, page 46.]

Illuminating Engineering Society — Bellevue-Stratford, Philadelphia, Sept. 24-27. A. B. Oday, 29 West 39th St., New York.

Great Lakes Division, N.E.L.A. — French Lick Springs, Ind., Sept. 26-28; Engineering Section, Lorain Hotel, Madison, Wis., Oct. 23-26. T. C. Polk, room 110, 140 South Dearborn, St., Chicago.

American Electric Railway Association —Atlantic City, Sept. 30-Oct. 4. J. W. Welsh, 292 Madison Ave., New York.

Association of Electragists International—New Ocean House, Swampscott, Mass., Sept. 30-Oct. 3. L. W. Davis, 420 Lexington Ave., New York.

National Safety Council — Stevens Hotel, Chicago, Sept. 30-Oct. 4. W. H. Cameron, 108 East Ohio St., Chicago.

National Electrical Manufacturers' Association—Wardman Park Hotel, Washington, Oct. 7-11. S. N. Clarkson, 420 Lexington Ave., New York.

American Society of Mechanical Engineers—National fuel meeting, Bellevue-Stratford Hotel, Philadelphia, Oct. 7-10. C. V. Rice, 29 West 39th St., New York.

International Association of Electrical Inspectors—Southern Section, Ansley Hotel, Atlanta, Oct. 15-17. R. L. Gatewood, P. O. Box 1743, Atlanta.

Kansas Section, N.E.L.A. — Wichita, Oct. 17-18. H. Lee Jones, Kansas Gas & Electric Co., Wichita, Kan.

Public Utilities Association of West Virginia—Charleston, W. Va., Oct. 23-24. A. Bliss McCrum, P. O. Box 1483, Charleston, W. Va.

American Engineering Council—Mayflower Hotel, Washington, Oct. 24-25. L. W. Wallace, 26 Jackson Place, Washington, D. C.

North Central Division, N.E.L.A.—Accounting Section, Nicollet Hotel, Minneapolis, Oct. 28 and 29. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

Public Utilities Association of Virginia —Chamberlin-Vanderbilt Hotel, Old Point, Va., Nov. 21 and 22. A. B. Tunis, 306 Grace Securities Bldg., Richmond, Va.

American Institute of Electrical Engineers—District meeting, Chicago, Dec. 2-4. F. L. Hutchinson, 33 West 39th St., New York.

LAKE SUPERIOR COMPANY GIVES PARK TO ASHLAND, WIS.—Lake Park, a recreation spot of much attractiveness in Ashland, Wis., has been given to that city by the Lake Superior District Power Company on condition that it be maintained for at least ten years.

WESTERN WASHINGTON ELECTRIC'S NORTH RIVER PROJECT.—The Western Washington Electric Light & Power Company of Aberdeen, Wash., has obtained a state permit granting it water rights on North River for its proposed hydro-electric power plant in the southern part of Grays Harbor County. To produce 54,545 theoretical, or 25,000 installed, electrical horsepower an appropriation of 5,000 sec.-ft. of water is necessary. A total of 272,000 acre-feet of water is to be impounded in a reservoir to be headed with a concrete arch-type dam 153 ft. in height, 400 ft. along the top and 180 ft. at the bottom. The power plant will be approximately 10 miles south of the south shore of Grays Harbor, according to plans on file in Olympia, Wash. Completion of the project is expected by June, 1932.

COST OF LIGHTING NIAGARA BRIDGE.—Advocates of public ownership have claimed that a much lower rate is charged for lighting on the Canadian half of the International Bridge at Niagara than is charged by the American company for lighting the American half of the bridge. An inquiry has revealed that the total use of electric lighting service on the Canadian side of the bridge during the months of January, February, March, April and May, 1929, was 26,620 kw.-hr. and the net amount of bills for this service was $239.18, while the total use of electric service for lighting the American side of the bridge during the same period was 20,114 kw.-hr. and the net amount of bills for this service was $173.97. It appears, therefore, that during this five-month period the average kilowatt-hour rate on the Canadian side was 0.00898 cent, while on the American side it was 0.00868 cent.

NEWLY PLANNED ROANOKE RIVER PLANT MAY GENERATE 80,000 HP.—Additional information about the New York interests that are said to be accumulating land in Mecklenburg County, Va., for a hydro-electric development on the Roanoke River near Boydton is to the effect that an 80,000-hp. plant is in contemplation. The site will, it is said, eventually comprise about 15,000 acres of land. The Boydton site is about 15 miles above the spot at Boyd's Mill where the Virginia-Carolina Power Company proposed last winter to construct a hydro-electric plant, plans for which were dropped when the company was bought by the Virginia Electric & Power Company. A few miles lower on the river is the Bugg's Island site. And farther south are the two sites, one in Virginia and one in North Carolina, awaiting development by the Virginia Electric & Power Company.

Wisconsin to Take Rate Basis to Supreme Court

That efforts are to be made by the Wisconsin Railroad Commission to obtain from the United States Supreme Court a decision making the cost of reproduction less of a controlling factor in public utility valuations for rate-making purposes is a deduction made from an announcement issued from the office of the Attorney-General of the state that the decision of the United States District Court for the Western District of Wisconsin in the Washburn waterworks case is to be appealed to the United States Supreme Court in behalf of the Railroad Commission.

In this case the commission fixed the valuation of the property of the Washburn company for a rate-making basis at $75,000, although it was admitted that the cost of reproduction of the plant would be in excess of $87,000. Three United States judges tried the case in April and set aside the rate order. It is this decision that is now being appealed. In its order the Railroad Commission cited among other reasons for fixing a value less than the cost of reproduction a shrinkage in the consumption of water at Washburn due to a falling off in population. An increase in rates is now in force there, protected by an injunction from the United States courts.

Commission Rulings

RIGHT OF EMINENT DOMAIN ON SHORE OF GENESEE RIVER GRANTED WHERE NO OVERFLOW OR DIVERSION IS INVOLVED.—The New York Public Service Commission on September 13 approved a recommendation permitting the Rochester Gas & Electric Corporation to exercise the right of eminent domain in respect to certain real property in Rochester which is required for the development of water power in the Genesee River. The consent of the owners of the property to issuance of a certificate of public convenience and necessity was filed, as was a resolution of the Rochester Common Council consenting to the raising of the waters of the Genesee River and the condemnation of lands. The company seeks only the additional land that lies between the flowage line of the old dam and the flowage line of its new dam on the Genesee River when it is in maximum operation, and the commission declared it in the public interest that additional power should be developed by the acquisition of this strip. There would be no overflow of usable land, since the project is developed in a gorge. The state has never granted to any person or corporation the right to divert waters from the Genesee River and no diversion rights are effected, the commission said.

CONTRACTS BETWEEN POWER COMPANIES TO SELL AND BUY ENERGY.—In adjusting the rates of the Pacific Power & Light Company for its Yakima-Walla Walla district, the Washington Department of Public Works dealt with the purchase of power by the Pacific Power & Light from the Washington Water Power Company. The commission said that a few of the many important features entering into a determination of rates to be charged by contract for service between utilities are the type of business, the date and length of the contract, the size and character of the load, whether the energy to be purchased is for power, necessary load expenditures, size of the peak-load factor and distance of transmission. The utility selling power by contract to another utility should, the commission said, receive the fixed charges on all equipment necessary to furnish the amount of power required and, in addition, should receive an amount equal to the operating expenses to generate the energy used by the purchaser. The commission observed that a fair comparison of contracts fixing rates for service between utilities is virtually impossible as, like many other legal instruments, the difference in one or more clauses places the instruments on an entirely different basis.

WHAT CONSTITUTES AN EXTENSION TO A HYDRO-ELECTRIC PLANT?—Refusing to entertain the Tennessee Eastern Electric Company's plea that in seeking a permit for a hydro-electric plant on the South Fork of the Holston River its allied company, the Tennessee Eastern Power Company, was merely asking authority to enlarge an existing plant and therefore should be preferred to a rival applicant, the Tennessee Railroad and Utilities Commission said that the contention was unsound. The commission observed: "Even if the application had been made by the Tennessee Eastern Electric Company, which does have a development on a different watershed over on the Nolachucky River and serves the public as an operating utility, such company would not fall within the exceptions contained in the act of 1923. If this could be considered an extension of an existing utility, there is not a power site located on any stream in the State of Tennessee which could not be pre-empted by some other operating utility, because there is not a county in the state which is not already served by or adjacent to some operating public utility which could claim that it was only extending an existing plant."

SEASONAL AND PERMANENT CUSTOMERS.—A customer of the Eastern New Jersey Power Company protested against a charge of $3 for the disconnection of electric service to his summer residence at a seaside resort, claiming that he did not come under the company's rule covering service for less than six months. The New Jersey Board of Public Utility Commissioners dismissed the complaint, holding the charge to be reasonable, but made the following comment: "Customers taking service continuously for several years do not impose a recurring cost for connecting and disconnecting their service; seasonal customers do. Hence it is reasonable that the electric utility should segregate such customers and impose a proper charge for connection and disconnection of service on the customers entailing such seasonal costs. The record indicates that in this case the service man had to make several visits before he could obtain a reading of the meter inside the house, although the actual disconnection had already been made on the outside. This charge, in territory having a large proportion of seasonal customers, should be imposed upon making the connection of service, thus avoiding confusion and dispute at the termination of service for the season, be it four months or eight months. The company's rule should be amended to cover a season and not a definite number of months."

Recent Court Decisions

TECHNICAL OBJECTIONS TO TRIAL WHERE MAN WAS CONVICTED OF METER JUMPING OVERRULED.—State vs. Rousten was a meter-jumping case in which the defendant, who was convicted, appealed on various technical grounds, taking exception to the admission of certain evidence and to the form of the indictment and maintaining that the intercepted energy was not supplied to him personally, as charged, but to a bakery of which he was proprietor. These exceptions were all brushed aside by the Supreme Court of New Hampshire, which sustained the conviction. (146 At. 870.)*

NEBRASKA LAW PROVIDING FOR HYDRO-ELECTRIC DISTRICTS UNCONSTITUTIONAL.—The Nebraska Supreme Court has issued a mandate enforcing its findings in Searle vs. Yensen, in which it held unconstitutional the law which permits the organization by cities and rural communities, acting alone or jointly, of hydro-electric districts, with power to issue bonds to construct power plants and lines or for distribution systems alone. The case came to the court from Scotts Bluff County, where communities sought to take advantage of the nearness of government power developments in connection with irrigation dams. The court held that the act sought to confer legislative powers on the courts, and the decision carried down with it a law enacted at the last legislative session which contained the same defects. The decisive character of the finding led the state to waive its right to file a motion for a rehearing, and with the issuance of the mandate goes final condemnation of the act.

PREVENTION OF COMPETITION AN INHERENT PURPOSE OF COMMISSION REGULATION.—Competition previously permitted, if not encouraged, by the West Virginia Public Service Commission has been declared by the highest court of that state to be something which it is the commission's duty to prevent. In Huntington Brick & Tile Company vs. United Fuel Gas Company the court said: "It is very manifest from the state and federal statutes on the subject that the principal purpose of all commission regulation of public service corporations is to require uniformity in rates, prevent unjust discrimination in rules and practices by them, unnecessary duplications of plants and facilities, and unjust burdens upon the public resulting therefrom, or ruinous competition between persons and corporations employed in the public service." The commission, says *Public Utilities Fortnightly*, filed a very carefully prepared petition for rehearing, pointing out among other things that the court had repeatedly held previously that the commission is limited to the powers conferred by statute, whereas in its latest opinion the court had read into the statute, by implication only, a power in the commission to relieve the public service corporation from the performance of one of its fundamental duties, thereby usurping to the court a legislative function, contrary to the constitution of the state. Nevertheless a rehearing was refused by the court, and the commission has accepted its construction of the law.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

News About Electrical Men

P. S. Arkwright Heads Edison Illuminating Companies

Preston S. Arkwright, president of the Georgia Power Company, was elected president of the Association of Edison Illuminating Companies at the recent convention held in Quebec. The selection of Mr. Arkwright as president of this national association brings to its head a man who has won the recognition of the electrical industry on frequent occasions.

A native of Georgia and a graduate of the University of Georgia, Mr. Arkwright practised law in Atlanta for ten years before he entered the public utility field as president of the Georgia Railway & Electric Company on its organization in 1902. His success in building up a consolidated system out of a disorganized situation attracted the attention of the light and power executives throughout the country and in a short time he was among the industry's progressive leaders. During his tenure of the office of president of the Atlanta utility company hydro-electric power development in that section of the country has made gigantic strides and many development projects have been successfully undertaken. In addition to being chief executive of the Atlanta company, Mr. Arkwright is president and a member of the board of directors of the Columbus Electric & Power Company.

RAY P. STEVENS, president of the Niagara Hudson Power Corporation, has been elected a director of the Buffalo General Electric Company.

W. C. CARTER, formerly vice-president in general charge of production at all Link-Belt plants, has been appointed vice-president and general manager of the Chicago plant to succeed F. B. Caldwell, who has resigned because of ill health.

O. C. MERRILL, formerly executive secretary of the Federal Power Commission, has sailed for Paris to attend the annual meeting of the international executive council of the World Power Conference as chairman of the American committee. He is the American member of the executive council. Mr. Merrill will return to Washington late this month.

ERNEST SLATER, editor of the *Electrical Times*, well known British electrical weekly, will leave England about the middle of October for America with a view to obtaining the latest information concerning electric power development in the United States and Canada. Mr. Slater has devoted considerable time to the study of electric light and power systems and has visited some hundreds of power stations in the past twenty years. He is a member of the Institution of Electrical Engineers and Institution of Mechanical Engineers.

WILLIAM R. L. DWYER has been appointed chief engineer of the Ohio Public Utilities Commission following the reorganization of the commission. Mr. Dwyer, who has been a telephone engineer for the commission during the past fifteen years, will be in charge of the entire engineering and accounting departments. The separate departments of telephone, electric power, gas and water engineering have been abolished and co-ordinated to form a new engineering division, in charge of rate proceedings, sales of utilities, etc.

Buffalo, Niagara & Eastern Elects New Officers

Directors of the Buffalo, Niagara & Eastern Power Corporation at their recent meeting held in Buffalo elected PAUL A. SCHOELLKOPF chairman of the board, ALFRED H. SCHOELLKOPF president, Colonel WILLIAM KELLY vice-president and general manager and CHARLES D. WARREN secretary. JACOB F. SCHOELLKOPF, who has been chairman of the board since November, 1926, and previous to that time was chairman of the executive committee, and also chairman of the board of the Niagara Falls Power Company, tendered his resignation. Walter P. Cooke, who has served as secretary since the organization of the company in 1925, also resigned.

Paul A. Schoellkopf, the new chairman, was formerly president. For a number of years he had been a leading figure in the electric light and power industry and in the industrial and commercial life of the Niagara area. Since 1918 he has been president of the Niagara Falls Power Company, and in addition since 1925 president of the Buffalo, Niagara & Eastern Power Corporation. In addition to his numerous business connections Mr. Schoellkopf is a member of the State Reservation Committee at Niagara, a trustee of the Niagara Falls Memorial Hospital and also serves as chairman of the Development Committee of the Niagara Area.

Alfred H. Schoellkopf, previous to his connection with Buffalo, Niagara & Eastern, was for a number of years vice-president and general manager of the Niagara Falls Power Company. Since 1926 he has been vice-president and general manager of the Buffalo, Niagara & Eastern Power Corporation and has served on a number of directorates of business institutions in the Niagara area. He is chairman of the industrial committee of the Buffalo Chamber of Commerce, a member of the Buffalo City Planning Association and a trustee of the Buffalo General Hospital.

Colonel William Kelly is an internationally known engineer and an authority on water-power development. During his army career he was in charge of construction and engineering projects in practically all parts of the United States and its possessions. Colonel Kelly has also served as chief engineer of the Federal Power Commission and director of engineering for the National Electric Light Association. He is a graduate of the United States Military Academy at West Point and the Sheffield Scientific School of Yale University.

Charles D. Warren has for a number of years been assistant secretary of the Buffalo General Electric Company and assistant secretary of the Buffalo, Niagara & Eastern Power Corporation since its organization. He received his training in the power industry with the Buffalo General Electric Company, working in practically all phases of the business.

Obituary

Harry M. Edwards

Harry M. Edwards, vice-president of the New York Edison Company in charge of accounting, died suddenly at his home in New York September 18. Mr. Edwards had been identified with the Edison organization and its predecessors since 1889 and in the course of his public utility career had been actively connected with the National Electric Light Association and the Association of Edison Illuminating Companies.

Financial and Statistical News

PUBLICITY directed to the high prices of some of the stock market leaders, especially by bear interests, tends to obscure the fact that many standard stocks are now selling far below the year's high. This is obviously brought about by periodic corrective movements which have occurred about every two weeks on the average.

——FIFTEEN REPRESENTATIVE UTILITY AND UTILITY INVESTMENT company common stocks on September 16 averaged 21 points below their tops. The range of recession from top prices was eight to 57 points.

——BIDDING FOR CONTROL OF OPERATING UNITS on the part of investment trusts and other large groups continues to be a bullish market factor, apart entirely from the heavy minority buying which has been attributed to the trusts.

Pacific Gas & Electric to Issue Rights

Directors of the Pacific Gas & Electric Company have authorized the issuance to common-stock holders of two separate rights to purchase additional common stock. The first right will be to purchase one additional share at $25 for each ten shares held and the second permits the purchase of one additional share at $55 for each ten shares held. Rights will apply to stockholders of record of approximately Sept. 30. The first right is called "par offering No. 5" and is similar to others offered at intervals since 1925. The second is a special offering. The funds derived from the sale of stock under these offerings will be used in the execution of the company's construction program, which includes extensive additions.

Utilities Power & Light Report Shows Increased Revenue

In the annual report just issued covering the twelve months ended June 30, 1929, the Utilities Power & Light Corporation shows gross revenue amounting to $48,326,766, as compared with $43,240,584 for the year ended Dec. 31, 1928, and net revenue totaling $9,602,589, as against $9,211,933 for the year ended Dec. 31, 1928. Gross revenue for the twelve months ended June 30, 1929, was $19,763,020 greater than that for the twelve months ended June 30, 1928, and the net income after all deductions was $3,020,678 greater. But these increases are due in part to the inclusion of earnings of properties acquired subsequent to the issuance of the first report. Subsidiaries of the Utilities Power & Light Corporation include the Central States Utilities Corporation, Colonial Gas & Electric Company, Eastern New Jersey Power Company, Indianapolis Power & Light Company, Interstate Power Company, Laclede Gas Light Company and the Greater London and Counties Trust, Limited.

To meet the increasing demands for service in the territory of the properties located in Indiana, a superpower plant of 160,000 kw. capacity is being built on the White River, near Indianapolis. This plant will be in operation in the autumn of next year. The growth of the New Jersey properties has made necessary additional generating capacity, which is being provided for by a superpower plant of 200,000 kw. on the Raritan River, to be in operation by June of next year.

The total dividends paid during the twelve months were $4,740,969, leaving a surplus for the year of $1,258,199.

France Has 6,085,756 Kw.

The Syndicat des Entrepreneurs de Reseaux et de Centrales Electriques has recently issued a return on the position of electricity supply in France at the beginning of the present year. It shows that out of 37,981 towns and villages in the country 22,479, or 60 per cent, have now a supply of electricity available, as against only about 6,000 at the end of the war, and that the total capacity of the public service electricity plants now in operation in France is 6,085,756 kw., made up of 4,349,017 kw. in steam plants, 1,599,677 kw. in hydro-electric stations and 137,062 kw. in miscellaneous installations.

Stock Exchange Adopts Safeguards in Investment Field

CERTAIN rulings recently adopted by the New York Stock Exchange with a view to safeguarding investors, relating in part to the investment trust, are of interest to the utility field, in view of the increasing importance of that institution in this field. They also relate to policies such as payment of stock dividends, and refer to the issue of non-voting stocks, which have been prevalent more or less in the utility industry.

Referring to a provision recently incorporated in the Stock Exchange rulings to the effect that investment trusts should not include stock dividends in their income accounts, the report of the special committee on stock dividends says:

> The interest of the Stock Exchange in the method by which companies account for stock dividends arises out of its consistent policy of attempting to obtain in connection with corporate returns such a clear disclosure of the relevant facts as will enable the investor properly to appraise the listed securities in which he is interested. . . .
>
> Coincident with the development of the stock dividend there has taken place the development of the less than $100 par and of the no-par value stock, together with the practice of having large capital or paid-in surpluses, and these relatively new conceptions have led with increasing frequency to the corporate practice of partial or complete recapitalization through the form of so-called "split-ups."
>
> As a matter of definition, from the point of view of the exchange, a true stock dividend represents the capitalization in whole or in part of past or current earnings, while the split-up has not of necessity any relation to earnings and may mean nothing more than a change in the form in which ownership in an existing situation is expressed.

What the new ruling says, in short, is that corporations whose stock is listed on the New York Stock Exchange and who pay stock dividends must indicate clearly whether such dividends capitalize past earning power or are merely an increase in the number of shares through what is equivalent to a spilt-up of their stock. The object is to prevent misleading accounting practices which may deceive the investor. There is obviously no criticism of the stock dividend as such, but the ruling is considered advisable in view of the large number of corporations adopting this policy for the first time.

Referring to the handling of stock dividends received for the account of investment trusts and holding companies, the report says: "At the present time it appears as if the exchange could go no further than to take the position that it will raise no objection to the method by which investment trusts, holding companies and others account for stock dividends received by them and not realized upon, provided there is the fullest disclosure of the procedure adopted, and provided that these are not included in the income accounts of the receiving companies at a greater dollar value per share than that at which they have been charged

to income account or earned surplus account by the paying companies. The manner in which receiving companies account for stock dividends received by them and realized upon during the period under review is a matter which the committee will pass on in connection with each specific instance.

RULING IN RE INVESTMENT TRUSTS

Another ruling of the Stock Exchange has to do with the formation of investment trusts by exchange members. It requires that where members are contemplating organizing and publicly offering the securities of an investment trust the advertisements and circular, and also a copy of the charter and by-laws of the proposed corporation and any management or other similar contract be submitted to the committee in duplicate prior to the date of offering. This is merely a means of controlling the growth of the investment trust movement so far as exchange members are concerned.

No further ruling was made on the question of non-voting stock, although it has recently been the policy of the Stock Exchange not to list non-voting common stock.

Cheap Domestic Power May Penalize Industry

According to a serial report of the water-power development committee of the National Electric Light Association, which is now on the press, "a saving of a few dollars a year to the individual householder in cost of energy for domestic use through subsidizing that service at the expense of industrial users is not to be compared with the advantages of steady employment, regular wages and the consequent higher standard of living."

In the opinion of the committee sufficiently low industrial rates make it possible for large industries to be built up, producing abrasives, metal alloys, aluminum, bleaching materials, etc., at much lower cost than they can otherwise be produced. "This is passed along to the ultimate consumer everywhere," continues the report, "when he purchases automobiles, kitchen utensils, cutlery, soap, newspapers, tools, etc.. Furthermore, this low-cost energy is fundamental to the growth and expansion of that class of basic industry.

"In Canada we have two fairly large examples of different ways of using cheap water power. For about fifteen years Ontario Province has been operating to favor the domestic consumer at the expense of the commercial and industrial user, whereas for about five or six years Quebec Province has followed a policy of using its cheap water powers to stimulate industrial growth. While the Quebec policy has not been in existence long enough to obtain full effect, it was thought that a comparison of the growth of industry in Quebec and Ontario might give some indication of the results obtained under the different policies. W. M. Carpenter, research statistician of the National Electric Light Association, has compiled the accompanying table from data furnished by the Bureau of Statistics, Ottawa, Canada. The table shows results which are certainly worth consideration by statesmen, financiers and economists in this country."

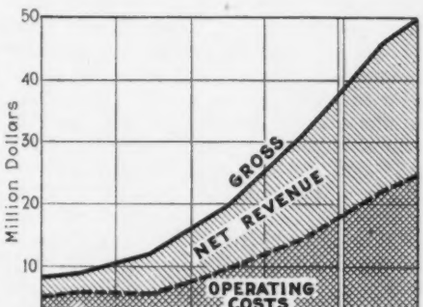
Comparison of Growth of Power and Business in Ontario and Quebec

Percentage Increases, 1925 to 1927

	Quebec, Per Cent	Ontario, Per Cent
Population	3.3	2.7
Electric Power		
Main primary horsepower	23.9	6.0
Capital invested	31.7	10.3
Kilowatt-hours generated	61.3	28.2
Manufacture		
Capital invested	21.2	10.0
Employees	16.6	11.9
Salaries and wages	20.1	15.6
Value added by manufacture	26.5	17.2
"Value added," per capita	22.5	14.1
"Value added," per employee	8.5	4.8
Business and Wealth		
Bank debits to individual accounts	49.2	30.3
Building permits in cities	65.8	33.4

American & Foreign Power Doubles Its Earnings

ALMOST doubling its gross earnings and showing an increase of 65 per cent in its assets during the year ended June 30, the American & Foreign Power Company is approaching the half-billion-dollar class. This group of properties, serving sections of a score of progressive countries in South America and elsewhere, has shown unusually rapid growth and today appears to have entered upon an era of still more rapid expansion and development. There is evidence that the expansion of its subsidiaries will parallel the earlier growth of the utility industry in this country.



American & Foreign Power Earnings Since 1925

*Year ended June 30

The report of American & Foreign Power's subsidiaries, just issued, covering the year ended June 30, shows gross earnings of $45,554,230, against $24,177,970 a year ago. Net earnings were up over 83 per cent to $23,502,343. The balance applicable to the parent company rose from less than $10,000,000 to $20,399,027, and the balance of this applicable to American & Foreign common was $5,104,066, against $1,459,781 a year ago. This represents $3.43 per share on the number of shares outstanding at June 30, against $1.17 for 1928.

According to the company's report, a part of the total purchase price has been paid upon certain properties being acquired. The latest available report shows annual gross earnings of these properties, including earnings of the Shanghai International Settlement municipal electric plant recently acquired and one property under firm purchase contract, as well as all companies directly or indirectly controlled, at about $74,500,000 and net earnings, before depreciation, at $38,000,000.

Investment Company Bids for Pacific Coast Utilities

Further bidding for stock of the Pacific coast utility systems is under way, this time on the part of the Public Utility Holding Corporation of America, an investment trust recently floated by the Harris Forbes Corporation, American Founders Corporation and United Founders.

The offer made by the new corporation in the case of Pacific Lighting Company was three shares with warrants attached and two detached warrants for each share of Pacific Lighting Company common stock. For each common share of the Southern California Edison Company it offers two of its shares with warrants attached and one detached warrant; for each common share of the Pacific Gas & Electric Company it offers two shares with warrants attached and two detached warrants.

In the case of the Pacific Lighting Company it is understood that officers advised stockholders against accepting the offer.

The Public Utility Holding Corporation is a Delaware corporation, capitalized at 35,000,000 shares, comprising 5,000,000 shares of no-par preferred, 25,000,000 shares of no-par common and 5,000,000 shares of class A stock. Officers of the new company are: F. S. Burroughs, president; E. C. Cranberry and H. M. Addinsell, vice-presidents, and George E. Woods, secretary and treasurer, all of Harris, Forbes & Company, and George E. Devendorf of the American Founders Corporation, vice-president. Louis H. Seagrave is a member of the executive committee.

COMPANY ORGANIZED TO ASSIST SMALL TOWN INDUSTRIES.—The United Light & Power Industries, Inc., has been organized under the laws of the State of Delaware with a capitalization of 50,000 shares of no-par value common

Current Earnings Reports of Electric Light and Power Companies

	1929	1928	Per Cent Increase	Operating Ratio 1929	Operating Ratio 1928
American & Foreign Power & subs. (Year ended June 30)					
Gross earnings	$45,554,230	$24,177,970	88.5	48	47
Net earnings	23,502,343	12,806,158	83.5	..	..
American Power & Light & subs. (Year ended June 30)					
Gross earnings	86,451,688	67,731,372	27.6	49	53
Net earnings	44,087,966	31,611,445	39.4	..	..
American Water Works & Electric & subs. (Year ended July 31)					
Gross earnings	54,520,469	49,994,367	5.1	50	52
Net earnings	25,965,049	23,856,814	8.8	..	..
Carolina Power & Light (Year ended July 31)					
Gross earnings	9,282,870	8,970,783	3.0	46	52
Net earnings	5,062,701	4,332,547	17.0	..	..
Detroit Edison & subs. (Year ended August 31)					
Gross earnings	55,933,182	50,247,389	11.3	65	65
Net earnings	19,286,818	17,167,587	12.3	..	..
Engineers Public Service & subs. (Year ended July 31)					
Gross earnings	43,971,573	30,444,285	44.2	57	60
Net earnings	18,671,874	12,157,558	53.7	..	..

	1929	1928	Per Cent Increase	Operating Ratio 1929	Operating Ratio 1928
Federal Light & Traction & subs. (Year ended July 31)					
Gross earnings	8,294,486	7,512,590	10.4	59	61
Net earnings	3,401,448	2,936,897	15.8	..	..
Nebraska Power					
Gross earnings	5,713,459	5,117,955	12.0	51	53
Net earnings	2,797,795	2,412,696	16.0	..	..
New Orleans Public Service (Year ended June 30)					
Gross earnings	17,617,383	18,594,325	—5.0	62	62
Net earnings	6,587,966	7,131,773	—8.0	..	..
Portland Electric Power (Year ended July 31)					
Gross earnings	12,679,507	12,335,533	2.8	59	59
Net earnings	5,162,812	5,031,708	2.6	..	..
United Light & Power & subs. (Year ended July 31)					
Gross earnings	92,763,132	88,154,871	5.2	58	60
Net earnings	38,658,931	35,520,087	8.8	..	..

stock for the purpose of assisting, acquiring or financing small industries in the territory served by subsidiary companies of the United Light & Power Company. The new company is a subsidiary of the United Light & Railway Company of Delaware, which is controlled by the United Light & Power Company.

BOSTON EXCHANGE LISTS ELECTRIC INVESTORS STOCK.—The Boston Stock Exchange has authorized the listing of 20,000 additional shares (no par value) $6 preferred stock. The issue and sale of these additional shares were authorized by the board of directors on August 23, 1929, and the proceeds of such sale will be used to provide funds for the acquisition of additional interests in electric power and light companies and for other corporate purposes. At the present time there are outstanding warrants entitling holders to subscribe to 23,680 shares of common stock at $20 per share.

PUBLIC SERVICE COMMISSION AGREES ON INDIANA UTILITY ISSUE.—Breaking a deadlock which existed for more than a week, members of the Indiana Public Service Commission have approved the $15,500,000 bond issue of the Insull-controlled Northern Indiana Public Service Company. The order approving the issue, to be handled at 88 per cent, has been written for some time by John W. McCardle, chairman of the commission. He failed to secure the approval of two other commissioners needed for passage, on the ground that the bonds should be sold for not less than 90 per cent. An agreement, however was finally reached. A $7,500,000 issue, to be posted as collateral and not sold, also was approved. It has been many years since the commission has permitted bonds of this sort to be sold for less than 90 per cent of par and the action just taken is of extreme interest to all utility men of the state.

New Capital Issues

Empire Corporation

Allotment certificates.
Amount, 50,000 units.
Price, $58 per unit and accrued cash dividend.
Feature, each unit consists of one share of preferred and one share of common.

Empire Corporation has been formed, as announced in the September 14 issue of the ELECTRICAL WORLD, to acquire controlling interests and otherwise to invest in public utility enterprises. Each of these units consists of one share of cumulative convertible preferred stock ($3 optional dividend series) and one share of common stock with option warrant. Each share of preferred stock of this series is convertible at the option of the holder at any time after March 1, 1930, up to and including the second day prior to the date fixed for redemption into 2½ shares of common stock. Each option warrant will entitle the holder to purchase one share of common stock at any time after March 1, 1930, and on or before September 1, 1939.

Iowa Public Service Company

5½ per cent first mortgage gold bonds.
Amount, $1,300,000.
Price, 97 and accrued interest, to yield over 5.70 per cent.
Due date, September 1, 1959.

Iowa Public Service Company supplies electric light and power in more than 200 cities and towns in western and north central Iowa, including Waterloo, Charles City, Cherokee and Le Mars. The territory served is one of the richest agricultural sections in the world and includes a population of approximately 500,000. These first mortgage bonds were dated September 1, 1929.

City of Seattle, Wash. (municipal light and power plant and system).

5 per cent gold bonds.
Amount, $2,000,000.
Price, to yield 5.25 per cent.
Feature, maturities—$80,000 due each October 1, 1935 to 1959 inclusive.

These bonds are issued by the city of Seattle for the purpose of making certain additions and extensions to the existing municipal light and power plant and system, and are valid and legally binding obligations of the city of Seattle, payable, both principal and interest, together with bonds previously issued, from the revenues of the municipal light and power plant and system.

JERSEY UTILITY INCREASES STOCK.—Stockholders of the Jersey Central Power & Light Company at a meeting held September 13 voted to increase the capital stock from 500,000 shares of common stock to 1,000,000 shares and from 100,000 shares of preferred stock to 200,000 shares. The company has negotiated a contract for the initial supply of 8,000,000 kw.-hr. of electricity annually to the Lackawanna Railroad for its electrification. Another indication of the company's progress is the fact that a 50,000-kw. station at South Amboy, costing about $5,500,000, will be opened next April. The customers served by the company have increased from 57,264 on January 1, 1925, to more than 98,000 at the present time.

TAXATION ON MISSOURI UTILITY COMPANIES INCREASED.—The Missouri Tax Commission has recommended that the public utilities operating in the state, exclusive of gas, water and steam-heating companies and certain properties assessed locally, be assessed for taxation on a basis of $498,563,140. This is an increase of $12,443,653 over the taxation valuation fixed by the Board of Equalization in 1928. The increase largely represents the value of additions and betterments that have been made by utilities during the past year. Of the increase $8,474,114 was placed against electric light and power companies. The Union Electric Light & Power Company of St. Louis is valued at $25,894,694, an increase of $173,542 over 1928, and the Laclede Power & Light Company at $4,029,727, an increase of $549,717.

Business News and Market Conditions

Exposition Will Show New Wonders of Electricity

Destined to play an even more important part in the future than in the past, the electrical industry plans to unfold some of the great possibilities of electrical service at the coming National Electrical Exposition to be held in Grand Central Palace, New York City, during the week of October 7.

The light and power industry, entering as it does into all phases of economic and social life, will demonstrate at this exposition motivating ideas and goals, transcending purely business and mercenary considerations, by presenting what is practical and beneficial to those whom it would serve.

Electrical refrigeration will have an important place in the exposition from a practical and educational viewpoint when it is realized that electrical refrigeration can be financed out of the saving of food waste caused by spoilage which takes place in temperatures above 50 deg. F.

President Hoover has accepted the honorary chairmanship and will head the general committee on "Light's Golden Jubilee" celebration.

Non-Ferrous Metals Generally Quiet

Sales of both copper and lead decreased considerably in the week ended September 18, but prices were firmly maintained. The total sales of zinc improved, but this was attributable solely to one large order. Tin continues as stagnant as ever, at unchanged prices. Silver, at 50⅜ cents Wednesday, touched the lowest point registered in thirteen years. Though the non-ferrous markets have been quiet, reports from consuming interests are optimistic and an excellent fall and winter consumption of metals is indicated. More activity in all of the metal markets is expected during the next few weeks.

NEW YORK METAL MARKET PRICES

	Sept. 11, 1929 Cents per Pound	Sept. 18, 1929 Cents per Pound
Copper, electrolytic	18.25	18
Lead, Am. S. & R. price	6.90	6.90
Antimony	8.75	8.75
Nickel, ingot	35	35
Zinc, spot	7.15	7.15
Tin, Straits	45.38	45.12
Aluminum, 99 per cent.	24.30	24.30

Anticipate Continued Prosperity

"INDUSTRIAL and trade activity should continue at the present high rate for some time," the Conference of Statisticians in Industry, operating under the auspices of the National Industrial Conference Board, declared in its last report.

The conference analysis emphasizes the improvement in building construction, which established a new high monthly record owing to extensive undertakings in public works, and points out that although agriculture suffered considerable losses in certain sections, these were nearly balanced by bumper crops in other sections, so that the total purchasing power of agriculture for the year should come close to that of last year.

Exceptional activity in both industry and trade continued throughout the midsummer season, new July production records having been made in both the iron and steel and automobile industries, and building activity increased in spite of the fact that a seasonal decline would have been in order. Distribution as indicated by freight car loadings continued on the up-grade, increases being noticeable for all commodities excepting livestock during the month of July.

European Tariff Policies and American Trade

European criticism of the United States tariff policy is frequently directed to serve as a "red herring" to solidify local factions or opinion, according to an eminent authority on international relationships in an address before the McGraw-Hill staff this week. It was pointed out that most of the European countries themselves have exceedingly high tariff walls. Free-trade Britain, for example, secured $595,000,000 from her customs last year, against a total of only $542,000,000 realized by the United States Government from the customs.

Discussing the proposed European tariff union, the speaker pointed out that any major betterment in European conditions would be at once reflected in improving markets for American goods in Latin America and elsewhere. He anticipates no injury to United States trade from such a union, be it economic or even political in its major aspects.

Eight Months' Construction Up 20 per Cent

Engineering construction contracts reported in the first eight months are 20 per cent greater in value than in 1928; for the first seven months, 25 per cent. Seven months' figures now available for many materials and other factors show major business prospering and less favorable conditions prevailing in those lines that depend more on small building activity, according to *Engineering News-Record*.

The August rate for lettings was $70,000,000 per week, compared with $76,500,000 in July, $74,500,000 a year ago, and $82,500,000 average this year. The total for the month is $349,695,000.

The gain for the year continues to be chiefly in private construction (up 32 per cent); public up 2 per cent. Streets and roads, the only important backward influence this year, is now within 14 per cent of last year.

Value of Contracts by Sections in the United States and Total for Canada, August, 1929

Thousands of Dollars (000 omitted)

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States August, 1929	United States Year to Date 1929	United States Year to Date 1928	Canada August, 1929
Water-works	$702	$398	$68	$379	$1,190	$1,400	$4,138	$29,989	$36,359	$633
Sewers	766	1,554	398	2,839	623	412	6,592	59,935	69,712	362
Bridges	573	7,542	867	1,329	3,295	912	14,518	96,798	87,439	289
Excavations, etc.	49	105	231	75	15	120	595	19,375	23,239	1,142
Streets and roads	2,252	21,452	6,989	10,571	19,545	5,463	66,272	386,614	448,688	2,190
Industrial buildings	3,728	5,005	13,345	7,240	1,475	4,642	35,435	375,210	209,990	1,768
Commercial buildings	13,927	103,101	2,735	45,073	10,392	11,985	187,213	1,457,222	1,309,704	6,839
Federal government	16	539	9,784	343	1,528	1,009	13,219	82,712	42,997	.....
Unclassified	1,339	14,765	233	2,921	2,158	297	21,713	387,869	19,486	11,477
August, 1929*	23,352	154,461	34,651	70,770	40,221	26,240	349,695	.....	.....	24,700
July, 1929†	24,135	119,148	23,589	64,557	44,993	29,682	306,104	.....	.....	28,312
August, 1928*	26,693	110,846	38,251	96,793	59,186	35,794	367,563	.....	.....	15,449
Year to date, 1929	174,249	1,148,934	275,233	574,177	447,291	275,840	.....	2,895,724	.....	147,310
Year to date, 1929	165,511	877,840	178,552	596,682	355,225	223,904	.....	.....	2,397,614	107,004

Market Conditions

ELECTRIC RAILWAY equipment requirements have tapered off in the Eastern district but power companies and industrial interests are buying actively, and electrification programs of the steam railways are proceeding rapidly with substantial promise of future orders.

——OUTSTANDING ORDERS FOR EQUIPMENT are lacking this week in New England and the Southeast, but central station demand is increasing and manufacturers are optimistic.

——INDUSTRIAL AND RAILROAD BUYING is substantial on the Pacific Coast, while power company business has fallen off somewhat.

PACIFIC COAST

POWER company business is very quiet both in machinery and supplies. State department ordering is brisk, with many small jobs for various state institutions. Several substantial orders are reported in the Puget Sound area and construction is proceeding at a satisfactory rate there.

The week's orders include 29 7½-hp. General Electric motors for the jute mill at San Quentin prison. Railroad buying includes three carloads of No. 9 iron wire, a composite car of steel strand and bond wires and the intercommunicating telephone equipment for the fleet of Cascade Limiteds, first of its kind. Power apparatus sales cover $17,500 worth of Westinghouse elevator motors for a Los Angeles steel company, $60,000 circuit breakers and $18,000 transformers for a power company, $26,000 automatic switching equipment for San Diego, $40,000 worth of storage battery Westinghouse locomotives for an Arizona copper company, a $3,500 General Electric dynamometer equipment for an oil company at Martinez and three General Electric d.c. elevator equipments for San Francisco. Exceedingly large projects cover the $1,000,000 Curtiss airport for Alameda, the $1,250,000 school bond issue for San Jose and the one mile $6,500,000 tube between San Diego and Coronado, to be begun in December.

Puget Sound Power & Light Company plans spending $12,500 in new substation equipment in Everett, $60,000 in removing lines in business district, $12,000 in regulators at Stanwood, $10,000 in transforming Monroe substation from 500 to 1,500 kva., $7,500 in transformers at Arlington and $5,000 for regulators at Darrington. Specifications for a 5,000-kw. turbine for a pulp mill at Port Angeles, costing about $120,000, are out. Contract for a power plant at Medford, Ore., for the Consolidated Light & Power Company, costing $100,000, has been awarded. Vancouver, B. C., has bids out for 46,500 ft. of cable ranging from No. 10 down. Street lighting systems are planned in Mount Vernon, Wash., Washington Water Power Company, Spokane, expects to start work shortly on 22-mile transmission line extension. Two additional units to St. Helens Pulp & Paper Mill at Portland, Ore., are planned and Fir-Tex insulating Board Company, Portland, plans $2,500,000 plant at St. Helens. Construction contracts follow:

Pacific Gas & Electric Company, San Francisco, Calif., plans extensions in transmission lines to Agnew, Santa Clara and vicinity, to cost about $40,000. California Public Service Company, Alturas, Calif., plans steam-operated electric power plant to cost about $100,000. Western Sugar Refining Company, San Francisco, Calif., will build addition to storage and distributing plant to cost $250,000. Firestone Tire & Rubber Company, Akron, Ohio, will build a factory branch and distributing plant at Seattle, Wash., to cost $100,000. Shelton, Wash., plans ornamental lighting system. Toppenish, Wash., plans ornamental street-lighting system. Caldwell, Idaho, plans ornamental lighting system. Dorr Company, Denver, Colo., is reported planning plant at Englewood, Colo., for manufacture of mining machinery, to cost about $65,000. Public Service Company of Colorado, Denver, plans transmission line from Rifle to DeBeque, Colo. Tucson, Ariz., plans ornamental street-lighting.

SOUTHWEST

MOVEMENT of line construction materials continues in good volume and there has been an especially good demand for standard distribution apparatus. Manufacturers normally carrying a good stock of meters and transformers report their reserve practically exhausted. There has been a slight falling off in the sales of stock sizes of motors.

A St. Louis Power Company bought a bank of transformers for a new substation; a lot of 33,000-volt insulators; a switchboard for a southwestern mining company and a centrifugal air compressor for one of the plate glass plants. A contract aggregating $60,000 was closed for the building construction materials for a 33-story apartment building now being erected. Construction projects follow:

Glasco Electric Company, Kansas City, Mo., has plans for electric equipment manufacturing plant to cost about $75,000. Kansas City Power & Light Company, Kansas City, Mo., plans power substation at Country Club Plaza to cost about $75,000. St. Charles, Mo., is having estimates of cost made for a municipal electric light and power plant. Fairfax Airports, Inc., St. Joseph, Mo., plans installation of flood-lighting system and beacon lamps at proposed airport. Seminole, Okla., plans municipal electric light and power plant to cost about $60,000. Harrison, Ark., plans municipal electric light and power plant and will have estimates of cost made at once. The Arkansas Power & Light Company, Pine Bluff, Ark., plans installation of two hydro-electric power units at the Remmel dam. Rio Grande Oil Company, El Paso, Tex., is said to have plans for a refining plant to cost $1,000,000. Swift & Company, Union Stock Yards, Chicago, Ill., plan meat-packing plant at Paris, Tex., to cost $100,000. M-B Dairy Company, Waco, Tex., plans milk products plant to cost $200,000. Southwestern Gas & Electric Company, Shreveport, La., plans transmission line between Shreveport and Minden.

MIDDLE WEST

GENERAL business in the Middle West section continues on a satisfactory basis. There has been a sustained, even demand for most commodities, although a slight slackening of activity is noticeable in certain lines. The various utility companies are busy with a considerable amount of construction work, which is being advanced as quickly as possible before the advent of cold weather.

Some of the interesting orders placed this week include one for a 105,000-kw. turbo-generator set and surface air cooler equipment valued at $1,250,000, two standard steam generating units and one reheat boiler valued at $1,500,000, extension to substation to cost $35,000, 25 7½-kva., 25 10-kva. and 25 15-kva. distribution transformers, 3,000 5-amp. watt-hour meters and 790 Thompson meters 10 to 300 amp. capacity. Jobbers' sales are holding up well. Construction projects follow:

State of Michigan Boys' Vocational School, Lansing, Mich., plans new school unit to cost more than $200,000. Barco Manufacturing Company, Chicago, Ill., has filed plans for plant for manufacture of railway supplies to cost $150,000. E. I. duPont deNemours & Company, Chicago, Ill., will build addition to chemical and kindred equipment plant to cost $120,000. Bowman Dairy Company, River Forest, Ill., plans milk-bottling plant and power house to cost more than $500,000. Firestone Tire & Rubber Company, Akron, Ohio, will build an addition to cost $700,000. Delco Products Company, Dayton, Ohio, plans addition to automobile starting and lighting equipment plant to cost about $230,000. Master Electric Company, Dayton, Ohio, has filed plans for an addition to electric equipment plant to cost $250,000. Hall China Company, East Liverpool, Ohio, plans pottery plant to cost more than $600,000. Empire Steel Company, Mansfield, Ohio, plans additions to mill to cost more than $175,000. Republic Iron & Steel Company, Youngstown, Ohio, will build additions to mill at Warren, Ohio, to cost $1,000,000. Grafton, N. D., is asking bids until Sept. 24, for a municipal power plant to cost $70,000. Twin City Milk Producers' Association, Duluth, Minn., plans milk plant to cost $100,000. St. Paul, Minn., has approved plans for

ornamental lighting system. Nebraska Power Company, Omaha, Neb., has approved plans for an addition to local steam-operated electric power plant to cost $100,000. Peoples Gas & Electric Company, Mason City, Iowa, will build an addition to power plant to cost about $500,000.

EASTERN

SALES of electrical equipment continue to register at a high point in the Eastern district, despite a noticeable tapering off in electric railway accounts, as was to be expected after recent peak weeks. Power companies are in the market for substation and miscellaneous apparatus and there is a definite tendency upward in the demand from industrial interests. Marine business shows signs of early activity, following a rather dull summer period. Prices are firm and the situation in this line is very satisfactory.

Manufacturers of prime movers and other heavy electrical equipment are looking forward to an active concluding quarter of the year. A Northern New York central station has placed an order with a state maker for a turbo-generator unit to cost about $900,000. A motor order has been recorded with a metropolitan central station to an amount of $118,000.

The Delaware, Lackawanna & Western Railroad Company continues its purchases of equipment for the electrification of its suburban lines in New Jersey. The Westinghouse Electric & Manufacturing Company has booked orders from industrial companies for fourteen electric locomotives, and expects further early business in that line. The Brooklyn & Queens Transit Corporation has given an order to the J. G. Brill Company, Philadelphia, Pa., for 100 trolley cars of latest design, one-man control type, to cost $1,500,000, delivery to be completed within six months. An oil refining company in Texas has placed a commitment with a New York manufacturer for a turbo-generator unit to cost $225,000. Steel mills are entering the market for heavy duty motors, controls and other equipment and sizable business is looked for from that quarter; chemical plants and metal-working establishments are active market factors at the present time. Account for airport lighting equipment is showing up well. Construction projects follow:

Central Hudson Gas & Electric Company, Poughkeepsie, N. Y., has plans for an addition to generating station on Dutchess Avenue. American Aeronautical Corporation, Whitestone, L. I., will build an aircraft plant at Port Washington, L. I., to cost more than $400,000. Horace E. Dodge Boat & Plane Corporation, New York, plans plant at Newport News, Va., to cost $750,000. The Signal Supply Officer, New York General Depot, Brooklyn, N. Y., will receive bids until October 1 for ammeters (Circular 19); until October 8 for cable (Circular 21), and until October 8 for batteries (Circular 17). United States Rubber Company, New York, will build an addition to plant at Providence, R. I., to cost about $100,000. General Baking Company, New York, has filed plans for a plant at Indianapolis, Ind., to cost $200,000. Public Service Electric & Gas Company, Newark, N. J., plans extensions in transmission lines in vicinity of Menlo Park, N. J. Delaware, Lackawanna & Western Railroad Company, New York, will proceed with construction of a power substation at Denville, N. J. Delaware River Power Company, affiliated with the Atlantic City Electric Company, Atlantic City, N. J., plans installation of submarine cable lines under Delaware River, between Deepwater Point, N. J., power plant and Pigeon Point, Del. Viscose Company of America, Inc., Marcus Hook, Pa., plans addition to rayon mill at Parkersburg, W. Va., to cost more than $1,000,000. Pennsylvania Railroad Company, Philadelphia, Pa., plans freight terminal at Harrisburg, Pa., to cost $100,000. Pennsylvania State Highway Department, Harrisburg, plans laboratory to cost $125,000. Pusey & Jones Corporation, Wilmington, Del., will carry out an expansion and improvement program at shipbuilding plant to cost $250,000. Aviation Corporation of the Americas, Inc., New York, plans aircraft plant at Baltimore, Md., to cost more than $5,000,000. Western Electric Company, New York, has filed plans for another unit at new works at Baltimore, Md., to cost $500,000.

NEW ENGLAND

NEW ENGLAND sales continue to show an encouraging trend. Last week small motor sales gained in volume over the previous week. Orders for a number of loom motors were recorded. One manufacturer reported an increase in the number of orders for motors for power drive in mills. Small switch and control equipment orders are steady; a steady trend in sales is noted in scheduled materials.

New power control equipment and substation requirements recently placed include an order for two 37,500-kva. transformers, two 12,500-kva. condensers and two 7,500-kva. transformers, all of which will go into a new eastern Massachusetts substation. Additions to substations in this district are contemplated; one in an Eastern group recently added another bank of transformers. Street lighting is active. Hydro-electric machinery is being considered by engineers for a western Massachusetts plant to cost about $200,000; plans are in preparation for a 120,000-kw. hydro-electric plant on the Osage River, Missouri, by a well-known Boston engineering firm. Plans for a substation in Springfield to cost about $350,000 are being considered. Construction projects follow:

Warren Telechron Company, Ashland, Mass., plans addition to electric equipment manufacturing plant, reported to cost about $75,000. Du Pont Viscoloid Company, Leominster, Mass., plans addition to composition material manufacturing plant to cost close to $1,000,000. National Blank Book Company, Riverside, Holyoke, Mass., will build an addition to cost $100,000. Eastern Massachusetts Electric Company, Salem, Mass., plans super-power steam-operated electric generating plant to cost more than $10,000,000. Pratt & Whitney Aircraft Company, Hartford, Conn., has filed plans for a plant at East Hartford, estimated to cost $1,000,000.

SOUTHEAST

VOLUME of electrical business in the Southeast continues to show improvement, though few outstanding orders are reported. Construction has expanded somewhat with several fair-sized and a few large projects contemplated.

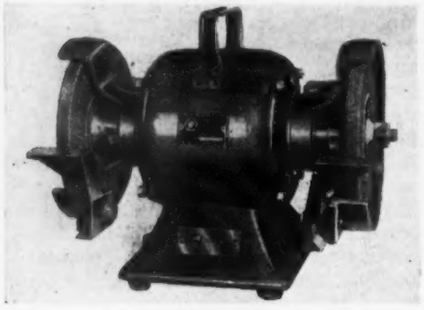
A small privately owned power company in Georgia ordered in the past week transmission line materials amounting to $10,000, while a power company in Louisiana ordered $7,000 in distribution and power transformers. Some other central-station orders were for $3,600 in distribution transformers and $2,700 for switchboard panel and relays. Some interesting business in prospect which will probably be placed this week is for $150,000 in transmission line materials for an interconnection of two of the larger power companies in this territory. Another order in more or less immediate prospect is for switchboard equipment amounting to $30,000 and going into a steam station in Georgia. A cotton mill in Georgia has let contracts covering the electrification of its mill which will cost, including substation, something over $23,000. Another cotton mill electrification in the same state will probably be announced next week. An industrial plant in Tennessee ordered water wheel generator equipment costing $5,500 and a hotel in Florida purchased lighting fixtures totaling $2,000. Construction projects follow:

W. M. Bassett Furniture Corporation, Martinsville, Va., will build an addition to cost $300,000. Catona Mining Company, Huntington, W. Va., plans power plant at coal mining properties near East Lynn, W. Va.; will also build tipple and install mining machinery. Kentucky Utilities Company, Louisville, Ky., will make extensions and improvements in power plant at Paducah, Ky., to cost $175,000. Buckeye Cotton Oil Company, Cincinnati, Ohio, plans cotton oil mill at Memphis, Tenn., to cost more than $100,000. Plough Chemical Company, Memphis, Tenn., has asked bids for factory to cost $1,000,000. Southern Public Utilities Company, Charlotte, N. C., contemplates extensions and improvements in transmission lines and distributing system at Ellenboro, N. C., and vicinity. Kingston, N. C., contemplates extensions and improvements in municipal power plant to cost about $80,000. Mobile, Ala., plans installation of floodlighting system and beacon lamps at municipal airport on the Cedar Point Road. Cordele, Ga., plans extensions and improvements in electric light and power distributing system to cost about $70,000. Georgia Power Company, Atlanta, Ga., is said to be planning hydro-electric power plant on Oconee River, near Sparta, Ga., to cost more than $250,000. Miami, Fla., plans ornamental lighting system. Newport Company, Carrollville, Wis., contemplates mill for manufacture of insulating board products at Pensacola, Fla., to cost more than $600,000.

New Equipment Available

Portable Bench Grinder

A new 6-in. ball bearing portable electric bench grinder is announced by the Black & Decker Manufacturing Company, Towson, Md. This machine is designed to meet the demand for a quality ball bearing grinder within the price range of the 6-in. and 8-in. sleeve bearing tools. The anti-friction bearings make it much easier to maintain



wheel speeds under load. It is for use on alternating current only, maintaining a 3,600-r.p.m. spindle speed on 60-cycle current and 3,000 r.p.m. on 50-cycle current.

Device Measures Sag in Transmission Lines

A small device designed to adjust transmission lines to a definite amount of sag and therefore to control the individual span is announced by the American Askania Corporation, Houston, Tex., under the trade name, "Kuppers Altimeter." The distinguishing feature of the apparatus is a parallelogram device coupled with a telescope that is free to swing in any direction.

The "Kuppers Altimeter" is erected at a convenient accessible point in the middle or outside the field of span. The plane of the parallelogram must be perpendicular to the plane of the span and fulfillment of this condition is insured by the familiar method of bringing down right angles. The sighting needle fitted to the instrument to facilitate rapid direction finding will then be parallel with the wire.

The measuring apparatus is set truly perpendicular by means of a circular spirit level. The telescope is then used to sight first one of the suspension wires, after which it is swung over to the second point. Using the fine adjustment screws, the two points are made to coincide on the cross-web; the telescope will then describe a straight line between the two suspension points. There is a graduated scale which at once shows the angle of inclination between the line connecting the two suspension points and the horizontal. By tilting the telescope, the connecting line is brought down exactly parallel; the operator having next ascertained by swinging to and fro that the plane of the line of sight is identical with a plane tangent to the overhead line, only a small further calculation is needed.

Motor Controls Designed for Air-Break Switches

A newly designed motor control equipment to meet the need in the field of high-voltage switching for a reliable mechanism to operate air-break switches by remote control from station switchboards is announced by the Pacific Electric Manufacturing Company of San Francisco. The new control is furnished in two sizes, MD-1 and MD-2, both for the operation of air-break switches having reciprocating type control rods. MD-1 is for switches up to and including 25 kv. rating and type MD-2 for switches up to and including 73 kv. rating.

Energy for the new control is supplied by either a.c. or d.c. motors. The motor rotates in the same direction for opening and closing of the air-break switch, energy being transmitted through suitable reduction gear units to an operating crank that raises or lowers the reciprocating vertical control rod as the air-break switch is closed or open. The type MD-2 control when equipped with a.c. motor is supplied with a magnetic brake. This brake is connected in series with the motor circuit so that when the motor circuit is closed the magnet holds the brake springs off the operator and when the motor circuit is open the magnet is cut out, allowing the springs to apply the brake.

Side-Break Switch with Rotating Blade

A new side-break switch with rotating blade and provided with means for attaching grounding switch as desired has been brought out by the Line Material Company, South Milwaukee, Wis. This new switch was designed by the company to provide a more economical switch than the three-insulator unit type. The mechanism is composed of simple bell cranks and standard pipe. All iron and steel parts are hot galvanized. The bearings are of bronze and work in full lined and long babbitted housings. The contacts are full floating and provided with a protective sleet hood and with two bolt terminals and strain clamps. The movable blade and stationary contacts can be furnished with or without arcing horns. The rotating blade, which is turned with the insulator, is hinged near the contact end to the casting, permitting a twisting action to break the seal of oxidation or ice.

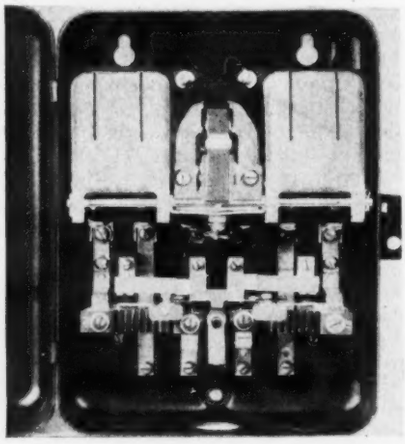
The design of the switch is such that it lends itself to the addition of a grounding switch without much expense. It is unique in its design in that the grounding switch uses the same contacts as the main line switch. An interlocking mechanism is provided which prevents grounding the line if the switch is closed and also prevents closing the line when the grounding switch is in the closed position, thus eliminating any accidental wrong sequence of operation of grounding switch and line switch, according to the manufacturer.

Insulators are used with a 3-in. bolt circle, which is standard for all voltages and capacities in which these switches are made, namely, 4,500 volts to 73,000 volts. The switch is made in capacities of 400, 600 and 800 amp. in two, three and four-pole units.

Across-the-Line Starter Has Many New Features

A newly designed across-the-line starter, called "6013 Aclinestor," with several new features and modifications is announced by the Sundh Electric Company, Newark, N. J. The new switch has full-voltage automatic starter for remote control.

Among the outstanding features of the new switch claimed by the manu-



facturer are the following: Few moving parts; rugged construction; accessible Sundh magnet; no iron current carrying parts; cadmium plated parts throughout; contacts instantly removable by use of a screw-driver; coil removable by loosening two screws; switch and thermo relay on two different cold-molded bases; thermo overload reset from outside of box; switches complete in three and four poles; thermo overload adjustable for time interval; accessibility—coil contacts and thermo relay element instantly removable, etc.

According to the manufacturer, the new switch has interrupted stalled rotor current far in excess of its greatest capacity. Start, stop and reset push buttons are straight through the box; there are no flexible leads.

2,300-Volt Wet Process Box Fuse

A new small 2,300-volt, 30-amp. fuse has been brought out by the Line Material Company, South Milwaukee, Wis. The housing is of highest grade wet process porcelain with a flashover value between terminals and hanger of 28,000 volts dry and 14,000 volts wet. The housing is provided with one petticoated lead entrance on each side. The box is provided with a galvanized steel adjustable vertical hanger which fits all standard crossarms. A hanger can also be provided to mount this fuse at an angle if desired. Contact clips are double phosphor bronze to insure evenly distributed pressure on the cartridge contact blocks.

This fuse has an over-all width of 3 in. from outside of lead entrance on one side of the box to outside of lead entrance on the other side of the box. It is only 6-in. high. The maximum rating of this fuse is 2,300 volts, 30 amp. continuous carrying capacity. The company also makes this fuse with a different design of cartridge which is known as "arc chute expulsion" type.

This small fuse has been designed to meet the demand for economical protection of small circuits where the expense of the present-day larger fuses would not be warranted.

Meter Service Breaker Has Longer Time Element

The development of a positive automatic circuit breaker, designated WK-50, is announced by the Westinghouse Electric & Manufacturing Company. This new breaker is safer than fuses, it is claimed, because its performance cannot easily be altered by adverse conditions. Because of its longer time element, it withstands temporary overloads, but it will open the line before any damage can be done to the equipment or to the insulation of the conductors, according to the manufacturer.

The service breaker is operated by a toggle switch, being quick-make and quick-break, thus eliminating contact burning and variable action. The features claimed for it are:

It eliminates tampering with fuses; it protects the customer from the hazards encountered when replacing blown fuses; service calls by the operating companies are eliminated as the customer can reset the breaker, thus decreasing the service expense to the central station; it has considerable time element, which permits the starting of domestic motors without tripping out.

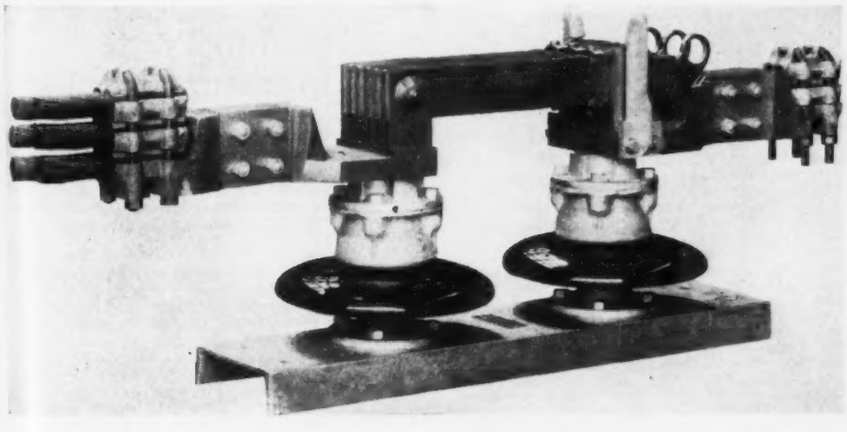
Disconnecting Switch with Pry-Off Type Latch

A new line of disconnecting switch, designated type BB-1, is announced by the Pacific Electric Manufacturing Corporation of San Francisco. The latch is of the pry-off type, which it is claimed securely locks the switch in a closed position. When opening the switch the latch exerts additional leverage to break ice or sleet at the start of the opening stroke.

Insulators are of the standard porcelain cemented cap and pin type. The contacts are of tongue type, with guides, blade and contact ground in on the blade grinding machine after the switch has been assembled. The terminals are of the standard two bolt solder type and the bases are hot dipped galvanized channel base; all holes are punched before being galvanized. The blade is of double busbar copper, heavy cross-section, to meet mechanical requirements, and are in excess of the current-carrying capacity.

Heavy-Duty, Single-Pole Disconnecting Switches

A new line of type B-2 heavy-duty, single-pole disconnecting switches is announced by the Delta-Star Electric Company, Chicago, Ill. The blade is furnished with guides and safety locks. The terminals are provided with multiple cable compression type lugs. The insulators are interchangeable and have a high mechanical strength.

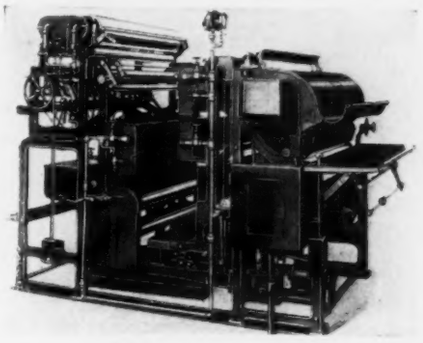


This feature makes the meter switch particularly adaptable for domestic use, because it allows for excessive starting currents of motor-driven household appliances.

Blueprinting Machine Is Direct Gear Driven

Unusual speed of production, high quality prints and low operating costs are claimed for the new Pease "Peerless" model No. 30 blueprinting equipment, as announced by the C. F. Pease Company, Franklin Street, Chicago. This new "Peerless" continuous blueprinting equipment is radically changed in design.

The new model is direct gear driven throughout, has a speed range of from



4 in. to 12 ft. per minute and is powered with a variable-speed ¼-hp. motor, direct connected to a fully inclosed gear reduction unit running in oil. At the extreme left hand side of the machine and mounted in the feed table is a special four-point autotype gearshift, providing for two forward speeds, high and low, and also neutral and reverse. This reverse gear is an entirely new departure in blueprinting machinery construction and permits the operater to withdraw tracings or run back the leader roll whenever desired, without inconvenience. At the right of the machine is another speed control in the form of a hand-operated dial, connected by a sprocket chain to a rheostat located beneath the feeding table. This additional regulator permits instant change of printing speed to exactly the proper degree to conform accurately with the character of the tracings.

The drier consists of two chromium-plated copper drums and an auxiliary air-drying unit. These units are in graduated heat arrangements and, because of the direct roll contact with the paper, the prints are dried smoothly and are free from wrinkles.

NEW ACCESSORY FOR PLANERS PERMITTING CONTROL FROM PENDANT PUSH BUTTON.—To meet the demand for control equipment which will allow all automatic operations of a planer to be governed from a pendant push-button station, the General Electric Company announces a new magnetic controller and push-button station designated CR-4602-L-5 and CR-2940-BS-14-CR respectively. The panel is of standard design with an added section on which are mounted the relaying contactors governed by the push-button station. This extra section may be added to standard pedestal type magnetic controllers now in service.

Electrical Patents

Announced by U. S. Patent Office

(Issued August 27, 1929—
Not Previously Published)

1,725,789. SAFETY SWITCH; E. M. Glasgow, Port Chester, N. Y. App. filed Feb. 9, 1924.

1,725,832. ELECTRICALLY OPERATED WATER HEATER; R. L. Shriner, Weehawken, N. J. App. filed Jan. 6, 1927.

1,725,853. CONDUIT BOX; T. A. Crotty, Erie, Pa. App. filed March 26, 1927.

1,725,877. ELECTROPLATING; O. L. Maag, Canton, O. App. filed Sept. 22, 1926.

1,725,883. CONNECTER FOR ATTACHING ELECTRIC CABLES OR CONDUITS TO OUTLET BOXES AND THE LIKE; A. C. Recker, Oakville, Conn. App. filed Feb. 10, 1928.

1,725,929. FOLDING MACHINE; C. W. Newton, Boston, Mass. App. filed March 20, 1920.

1,725,948. SHORT CIRCUIT ARRESTER; J. W. Arnett, Houston, Tex. App. filed June 17, 1927.

1,725,963. SWITCH MEANS; H. I. Morris, Lakewood, O. App. filed May 2, 1927.

1,725,968. OPERATING MECHANISM AND CONTROL MEANS THEREFOR; E. H. Remde, Cleveland, O. App. filed Dec. 10, 1923.

1,726,053. SAFETY COUPLER; L. A. Brown, Uniontown, Pa. App. filed Oct. 10, 1927.

1,726,131. ELECTRICAL CONTROL SYSTEM; R. J. Wensley, Edgewood, and T. U. White, Pittsburgh, Pa. App. filed May 15, 1924.

1,726,163. TIME-MEASURING DEVICE; W. T. Powell, Rochester, N. Y. App. filed April 17, 1922.

1,726,164. RELAY; F. E. Queeney, Teaneck, N. J. App. filed Aug. 11, 1926.

1,726,174. REVOLVING AUTOMATIC ELECTRIC TIME SWITCH; H. O. Brown, Jacksonville, Fla. App. filed Oct. 24, 1923.

1,726,179. SOCKET; M. B. Grout, Chicago, Ill. App. filed Feb. 8, 1926.

1,726,206. CRANK CASE OIL HEATER; V. N. Albertson, Minneapolis, Minn. App. filed Jan. 9, 1929.

1,726,223. CORK SEPARATOR FOR STORAGE BATTERIES; W. F. Grupe, Lyndhurst, N. J. App. filed Nov. 12, 1924.

1,726,225. GRAVITY FRICTION SWITCH; J. B. Hoff, Philadelphia, Pa. App. filed Aug. 17, 1927.

1,726,233. MOTOR-STARTING SWITCH; H. K. Krantz, Pittsburgh, Pa. App. filed Nov. 26, 1924.

1,726,236. ELECTRO CHEMICAL TREATMENT OF SALINE AND ALKALINE SOLUTIONS; H. C. Parker, Los Angeles, Calif. App. filed Sept. 26, 1928.

1,726,258. PROCESS OF TREATING OXIDIZED ORES OF LEAD; N. C. Christensen, Salt Lake City, Utah. App. filed Dec. 4, 1922.

1,726,277. SERVICE SWITCH MECHANISM; A. B. Rypinski, Laurelton, N. Y. App. filed Feb. 18, 1925.

1,726,283. ELECTRODYNAMICALLY-CONTROLLED FIGURE; R. F. Yates, Bronx, N. Y. App. filed June 10, 1925.

1,726,294. RADIO ACTUATED FIGURE TOY; L. C. Greene, Winthrop, Mass. App. filed April 24, 1926.

1,726,308. ELECTROPLATING APPARATUS; W. J. O'Neill, River Forest, Ill. App. filed March 7, 1927.

1,726,331. ELECTRIC METER; E. M. Ashworth, Toronto, Ont., Can. App. filed Oct. 25, 1923.

1,726,335. ELECTRICAL CONTACT-MAKING DEVICE AND ASSEMBLING THE SAME; R. B. Benjamin, Chicago, Ill. App. filed Dec. 22, 1927.

1,726,337. EMERGENCY HEATER; W. A. Brown, Philadelphia, Pa. App. filed July 14, 1927.

1,726,338. EMERGENCY HEATER; W. A. Brown, Philadelphia, Pa. App. filed Nov. 11, 1927.

1,726,348. SWITCH DEVICE FOR THE PRODUCTION OF LUMINOUS SIGNS; M. Haase, Buchschlag, near Frankfort-on-the-Main, Germany. App. filed Dec. 4, 1925.

(Issued September 3, 1929)

1,726,774. CONDENSER; R. H. Sullivan, Rochester, N. Y. App. filed Nov. 17, 1926.

1,726,784. TRAFFIC SIGNALING APPARATUS; T. A. Van Gundy, San Gabriel, Calif. App. filed June 14, 1926.

1,726,785. SELECTIVE RADIO CONDENSER; D. R. Wells, Los Angeles, Calif. App. filed June 27, 1927.

1,726,789. ELECTRICALLY OPERATED FLUID HEATER; F. Wurthrich, Aarau, Switzerland App. filed May 16, 1927.

1,726,807. DISCHARGE BLOCK; W. L. Cook, Chicago, Ill. App. filed May 1, 1924.

1,726,808. CONDUIT FITTING; J. W. Cox, Erie, Pa. App. filed May 20, 1925.

1,726,809. CONDUIT FITTING; J. W. Cox, Erie, Pa. App. filed May 20, 1925.

1,726,811. SIGNAL CONTROLLING MECHANISM FOR AUTOMOBILES; W. A. Eckert, Buffalo, N. Y. App. filed Dec. 9, 1926.

1,726,830. ELECTRIC STOVE; S. H. Hobson, Rockford, Ill. App, filed April 10, 1924.

1,726,835. SIGNAL SYSTEM; H. Hubbell, Bridgeport, Conn. App. filed Jan. 5, 1924.

1,726,846. ELECTRIC CONTROLLER; N. D. Levin, Columbus, O. App. filed Jan. 25, 1924.

1,726,866. ELECTROSTATIC VOLTAGE METER; H. Starke and R. Schroeder, Aachen, Germany. App. filed Jan. 7, 1928.

1,726,897. PUSH-BUTTON SWITCH; J. Horn, Leipzig, Germany. App. filed Aug. 1, 1927.

1,726,908. AUTOMATIC STATION; C. C. Levy, Pittsburgh, Pa. App. filed Dec. 9, 1927.

1,726,910. DIRECTION INDICATOR; A. H. Meisenheimer, Spokane, Wash. App. filed Feb. 23, 1927.

1,726,912. ELECTRICALLY OPERATED SIGN; E. Mohn, Rochester, N. Y. App. filed Jan. 16, 1928.

1,726,913. ELECTRIC CONTACT; K. Muller, Essen-on-the-Ruhr, Germany. App. filed May 17, 1926.

1,726,914. MOUNTING FOR SWITCHES AND OTHER ELECTRICAL APPARATUS; T. E. Murray and T. E. Murray, Jr., Brooklyn, N. Y. App. filed Sept. 21, 1920.

1,726,925. FASTENING FOR RAIL BONDS; E. Schenk, Pittsburgh, Pa. App. filed Nov. 13, 1924.

1,726,928. PHASE SEQUENCE RELAY; H. P. Sleeper, Newark, N. J. App. filed Jan. 8, 1924.

1,726,953. CIRCUIT INTERRUPTER; G. G. Grissinger, Wilkinsburg, Pa. App. filed Mar. 12, 1925.

1,726,961. AUTOMOBILE SIGNAL; F. L. Marsh, The Dalles, Ore. App. filed Dec. 14, 1926.

1,726,964. SWITCH OPERATING MECHANISM; R. H. Olley, Syracuse, N. Y. App. filed Dec. 4, 1923.

1,726,991. ELECTRICAL CONNECTOR; B. A. Lundy, Larchmont, N. Y. App. filed Sept. 3, 1927.

1,726,994. VEHICLE SIGNAL DEVICE; H. J. Murray, Brooklyn, N. Y. App. filed July 7, 1923.

1,727,002. CIGARETTE LIGHTER; W. B. Weaver, Birmingham, Ala. App. filed Mar. 9, 1928.

1,727,010. RADIO RECEIVING CIRCUIT; H. T. Friis and A. G. Jensen, Red Bank, N. J. App. filed Nov. 20, 1923.

1,727,030. HANDWHEEL WITH HORN BUTTON MOUNTED AT CENTER; H. D. Geyer, Dayton, O. App. filed Nov. 10, 1925.

1,727,034. SWITCH DEVICE; H. E. Norviel, Anderson, Ind. App. filed Nov. 18, 1926.

1,727,035. RELAY; F. H. Prescott, Anderson, Ind. App. filed April 1, 1924.

1,727,094. TUNGSTEN ELECTRODE FOR DETERMINING ION CONCENTRATION; J. R. Baylis, Baltimore, Md. App. filed July 16, 1924.

1,727,131. SYSTEM FOR LOAD CONTROL; J. C. Reed, Steelton, Pa. App. filed Dec. 16, 1926.

1,727,146. METHOD OF INSULATING ELECTRICAL CONDUCTORS; F. Wachter, St. Louis, Mo. App. filed Nov. 27, 1925.

1,727,148. ELECTRIC-LAMP SOCKET; E. C. White, New York, N. Y. App. filed May 6 1925.

1,727,170. ELECTRIC-IRON STAND; L. J. Kelly, Hornell, N. Y. App. filed June 9, 1927.

1,727,178. FUSE PLUG; C. Rippe, Bridgeport, Conn. App. filed June 23, 1927.

1,727,185. ELECTRIC LAMP FOR USE IN MINES; W. M. Thornton, Newcastle-Upon-the-Tyne, England. App. filed Sept. 24, 1928.

1,727,219. BATTERY TERMINAL CLAMP; J. B. Scharf and M. Roth, Chicago, Ill. App. filed Sept. 9, 1927.

1,727,224. ALTERNATING-CURRENT ARC WELDING APPARATUS; C. B. Waters, Montclair, N. J. App. filed Mar. 20, 1926.

1,727,233. ATTACHMENT PLUG; J. A. Fretz, Philadelphia, Pa. App. filed April 20, 1928.

1,727,249. REGULATOR; R. M. Petersime, Gettysburg, Pa. App. filed Jan. 7, 1926.

1,727,254. APPARATUS FOR MEASUREMENT OF THE LEVEL AND FLOW OF LIQUIDS; G. F. Shotter, New Southgate, England. App. filed July 22, 1925.

1,727,264. THERAPEUTICAL APPARATUS; G. H. Young, Des Moines, Ia. App. filed July 8, 1927.

1,727,274. SLIDING CURRENT COLLECTOR FOR ELECTRIC VEHICLES; J. Fischer de Tóváros, Budapest, Hungary. App. filed Jan. 27, 1927.

New Trade Literature

SPLICERS AND INSULATORS. — Bulletin No. 29 B. D. A. issued by the Everstick Anchor Company, St. Louis, Mo., describes Blackburn's boltless wire or messenger splicer and Blackburn's boltless strain insulators. The bulletin contains illustrations and tables descriptive of these products and listing prices. Some attention is also given to Blackburn's strand bender.

OIL-BURNING EQUIPMENT. — The Combustion Engineering Corporation, New York, has just issued a new catalog on Quinn oil-burning equipment which it manufactures. The Quinn oil burner is a simple, reliable and flexible oil burner of the steam atomization type. It is made in five sizes with ratings from 10 to 150 gal. per hour. Each size is illustrated and the different parts are numbered and can be easily identified from list of parts given in the catalog. For very viscous oil and low pressures the Quinn P-G-S (pressure-gravity-syphon) burner has been designed. This burner is made in three sizes and the different parts are also numbered in the illustrations for easy identification. The Quinn oil torch is a self-contained unit with hose, regulating valves and pressure tank. These torches are built in four sizes in capacities ranging from 3 to 20 gal. per hour. Oil regulating cocks and oil pressure regulating valves are also illustrated and described in this catalog.

GENERATORS. — Leaflet 20355-A has been issued by the Westinghouse Electric & Manufacturing Company covering type ES engine-driven alternating-current synchronous generators. This is a revised edition of the leaflet describing fully the new fabricated construction for these type ES generators. These generators are designed for direct connection to steam, gas or oil engines and are built completely of structural steel, fabricated with the electric arc. The leaflet is illustrated with installation views and detail photographs.

FORCED DRAFT FANS. — The American Blower Corporation has just published a catalog, bulletin No. 10401, showing standard forced draft fans for domestic heating plants. The catalog also gives application and technical data of interest and information concerning the installation of this product. A plentiful supply of diagrams and illustrations is used in this twelve-page booklet.

VENTURAFIN HEATING METHOD.— Models 1929 of the Venturafin unit heaters as made by the American Blower Corporation, Detroit, Mich., are described and illustrated in its bulletin 7818. The new units are made in four sizes to cover practically all industrial heating jobs and have been improved and refined very much over previous models. Each unit is equipped with air deflectors to direct the heated air toward the floor and most models are furnished regularly with speed regulators to give various degrees of heat as required. Venturafin is particularly adapted for use in industrial plants, warehouses, garages, stores, entrance ways, laundries, etc.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Basel, Switzerland (No. 40866) of electrical condenser elements.

Agency is desired in Munich, Germany, (No. 40804) for waving machines, vibrators, violet-ray apparatus, etc.

Agency and purchase are desired in El Salvador, San Salvador (No. 40865), for electrical installation supplies, such as wiring of houses, installation of motors and lighting plants; and electric lighted advertising signs, especially mercury vapor or neon signs.

Agency and purchase are desired in Glasgow, Scotland (No. 49854), for radio parts.

Agency and purchase are sought in Sandnes, Norway (No. 40856) for radio sets and accessories, low and medium priced.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Bread + Watt-hours = Toast

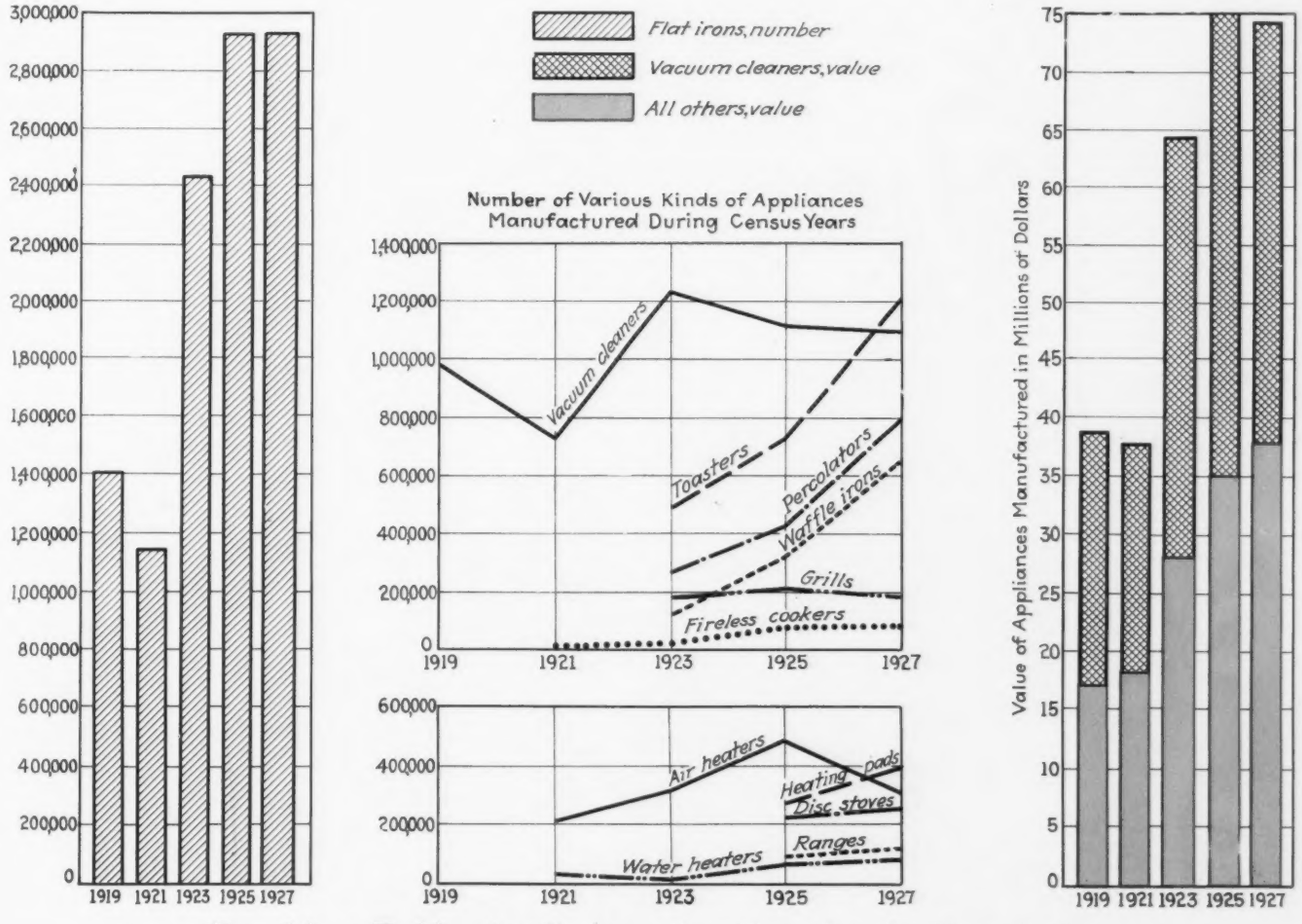
MORE toasters than any other household appliance except flat-irons and curling irons (are these a household appliance?) were manufactured in 1927, according to the Census of Manufactures. These, with vacuum cleaners, have been on the market a long time, as electrical conveniences go, and are well established. The first named have for a decade been produced at an average rate of 2,000,000 a year, lately rising to 3,000,000. For cleaners the rate is about 1,100,000 annually. But the most important gains, and a high present rate of production, are to be noted in the case of breakfast appliances, as they may be designated.

Toast coffee, and waffles called for the production of about 1,200,000, 800,000 and 650,000 of the respective electrical appliances. How rapidly the output is increasing is evident from the charts, which also show the production of all other electrical household equipment on which census statistics are collected. Fans, refrigerators and ironing machines are not included in this classification. Production statistics for 1927 are given in the table.

Number of Electric Household, Heating and Cooking Appliances Manufactured in 1927 (U. S. Census)

Toasters	1,209,484	Fireless cookers	73,406
Percolators	791,726	Flat-irons	2,937,258
Waffle irons	653,893	Curling irons	1,355,615
Heating pads	396,272	Vacuum cleaners	1,091,632
Disk stoves	253,042	Ranges (domestic)	112,963
Air heaters	306,112	Water heaters (over 660 w.)	63,664
Grills	196,304		

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers to quote or use them for any legitimate purpose. While no acknowledgment is required, users will, by crediting the ELECTRICAL WORLD, help it in obtaining and compiling further basic information.



Breakfast Table Appliances Are Growing in Popularity

Is the Appliance Load Worth While?

DOMESTIC appliances have increased the residential energy consumption in the United States by several billion kilowatt-hours annually, compared with the sales at the beginning of the present decade. To determine the amount accurately is clearly out of the question. An estimate can, however, be made which will give at least an approximate idea as to its magnitude.

On the basis of the production statics on the preceding page, supplemented by estimates for omitted years and for appliances not tabulated, the annual increase in energy consumption can be computed. The average yearly use of each appliance is known closely enough for the purpose.

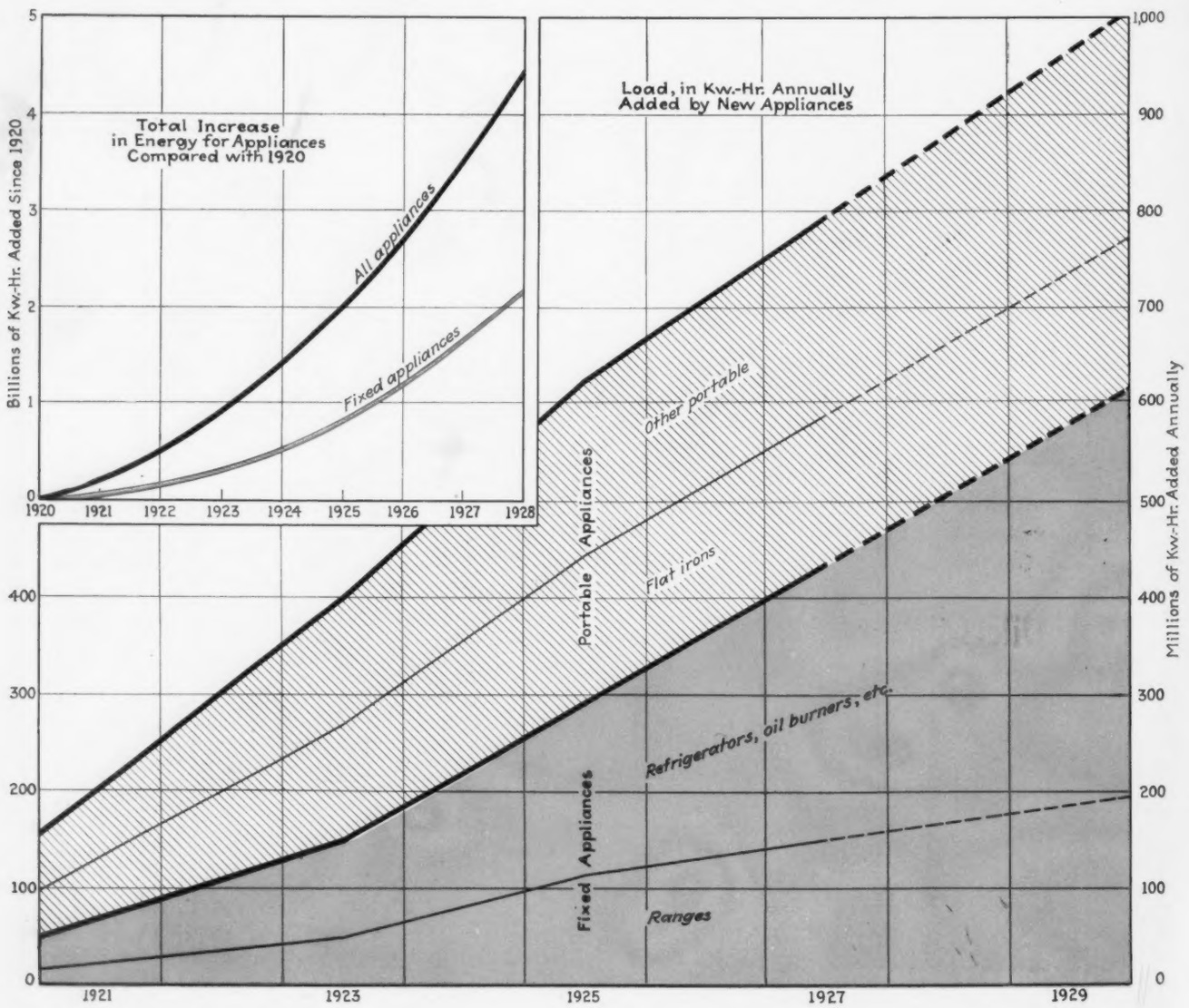
The result appears below. Thus, the appliances added during 1927 correspond to an increase of nearly 800,000,000 kw.-hr. over the preceding year's use. Somewhat less than half of it went to portable appliances; the balance to those fixed in place—ranges, water heaters, refrigerators, oil burners. Exclusive of flat-irons, the portables account for a quarter of the year's increase, or an addition to the revenue of $13,000,000.

The cumulative increase is represented in the smaller chart. It is found by adding each year's gain to the preceding. In 1927 the energy used for appliances, as thus estimated, exceeded that used in 1920 by three and a half billion kilowatt hours.

There may be some quarrel about the exact figure. An excellent analysis of last year's operations, made by the statistical research bureau of the N.E.L.A. and just published, points to a somewhat smaller increase, though no exact comparison can be made. There can be no disputing the general conclusion that household electrical appliances are adding hundreds of millions of kilowatt-hours to the load each year and that the amount continues to increase.

Appliances constitute the only channel through which residential use can be materially increased. Their convenience is generally recognized.

Their use is still far from common. Millions can go into homes not yet provided with them. Other millions will be manufactured for replacement. Generally speaking they are "off-peak" load for the residential distribution system as well as for the generating plant.



Appliances Account for Much of the Increase in Residential Energy Sales

Engineering Det

No. of Line (1)	Region, Name of Company and Terminals of Transmission Line (2)	Year During which Line was Connected (3)	Normal Rating of Line			Steel Towers or Wood Poles (7)	Number of Circuits per Tower Line (8)	Length of Tower Line, Miles (9)
			Load Rating per Circuit Kva. (4)	Voltage Kv. (5)	Cycles (6)			
	NEW ENGLAND							
	New England Public Service Co. (Central Maine Pwr. Co.)							
1	Gulf Island Station—Maxcy's Sub. Station	1928	24,000	66	60	Wood poles	1	35.0
	(Public Service Co. of N. H.)							
2	Dover—Jackman	1926	12,500	66	60	Wood poles	1	86.25
3	Jackman—Keene	1926	25,000	66	60	Wood poles	1	25.8
4	Keene—Vernon Station, N. E. Power Co.	1911—12	21,500	66	60	Steel towers	1	20.0
5	Garvins Falls Station—Lincoln	1929	12,000	66	60	Wood poles	1	70.0
6	Greggs Falls Station—Nashua	1929	42,500	66	60	Wood poles	1	19.1
	The Twin State Gas & Electric Co.							
7	Bennington, Vt.—Adams, Mass.	1915	2,500	66	60	Wood poles	1	17.9
8	Stamford—Pownal	1928	300	66	60	Wood poles	1	4.61
	New England Power Association							
9	Vernon-Pratts Junction—Clinton	1908	25,000	66	60	Steel towers	2	51.3
10	Leominster—Ayer—Nashua	1917—1919	10,000	66	60	Wood poles	1 (ult. 2)	25.9
11	Pratts Junction—Leominster	1917—1927	12,000	66	60	Wood poles	2	3.5
12	Bellows Falls—Pratts Junction	1927	80,000	110	60	Steel towers	2	59.25
13	Bellows Falls—Vernon	1914 and 192	5,000	66	60	Wood poles	1	31.4
14	Ayer—Tewksbury	1927—1928	75,000	110	60	Steel towers	1 (ult. 2)	19.0
15	Gardner Tap	1909—1917	5,000	66	60	Wood poles	1	3.4
16	Fitchburg Tap	1908	10,000	66	60	Steel towers	2	2.0
17	Westminster—Barre	1912	2,500	66	60	Wood poles	1	16.7
18	Clinton—Wachusett Dam	1917	4,000	66	60	Wood poles	1	1.7
19	Clinton—Worcester	1909	25,000	66	60	Steel towers	2	10.3
20	Worcester—Millbury	1912	25,000	66	60	Steel towers	2	10.8
21	Millbury—Webster—Conn. Line	1919	10,000	66	60	Wood poles	1	18.5
22	Harriman—Millbury	1924	70,000	110	60	Steel towers	2	74.3
23	Millbury—Pawtucket	1914	25,000	66	60	Steel towers	2	28.9
24	Millbury—West Medway	1926 and 1928	70,000	110	60	Steel towers	1 (ult. 2)	14.6
25	Shelburne Falls—Millbury	1913	25,000	66	60	Steel towers	2	60.3
26	Shelburne Falls—No. 5 Plant	1912	8,000	66	60	Steel towers	2	14.7
27	Searsburg—No. 5 Plant	1922	5,000	66	60	Wood poles	1	14.3
28	Vernon—Shelburne Falls	1912	8,000	66	60	Steel towers	2	20.7
29	Zylonite—Bennington	1915	2,500	66	60	Wood poles	1	17.9
30	Harriman—Zylonite	1925	32,000	110	60	Wood poles	1	12.2
31	Zylonite—Hancock	1923	32,000	110	60	Wood poles	1	17.6
32	No. 5 Plant—Zylonite	1913	7,000	66	60	Steel towers	2	8.2
33	Harriman—Sherman	1926	32,000	110	60	Wood poles	1	2.1
34	Palmer—Stafford Springs	1914	4,000	66	60	Steel towers	1	15.0
35	Ware—Palmer	1916	4,000	66	60	Wood poles	1	10.4
36	Pepperill Spur	1919	4,000	66	60	Wood poles	1	3.1
37	Uxbridge Spur	1914	25,000	66	60	Steel towers	2	1.4
38	Warren (R. I.) Spur	1919	15,000	66	60	Wood poles	1	2.3
39	Lincoln—Seekonk	1923	25,000	66	60	Wood poles	1	14.4
40	Providence—Seekonk	1918	25,000	66	60	Steel towers	2	5.0
	The Edison Electric Ill. Co. of Boston							
41	Waymouth—West Medway	1926	100,000	110	60	Steel towers	2	31.0
	Edison Electric Ill. Co. of Brockton							
42	Somerset (Montaup Station)—Brockton (Dupont Cir'l. Sub.)	1925	30,000	66	60	Steel towers		27.3
	Gardner Electric Light Co.							
43	Westminster (N. E. Power Co.)—So. Barre	1911	.....	66	60	Wood poles	1	16.0
	Fall River Electric Light Co.							
44	Seekonk Junction—Swansea Junction	1918	25,000	66	60	Steel towers	2	6.0
	Turners Falls Power & Electric Co.							
45	Montague City—Agawam Sub.	1917	25,000	66	60	Steel towers	2	48.8
46	Montague City—Pittsfield	1922—1923	27,000	66	60	Steel towers	2	36.7
47	Montague City—Springfield	1912	25,000	66	60	Steel towers	2	42.0
48	Agawam—Hartford, Conn.	1924	27,000	66	60	Steel towers	2	23.5
49	Amherst—Mount Tom	.....	15,000	66	60	Steel towers	1	8.4
	Blackstone Valley Gas & Electric Co.							
50	Pawtucket—Woonsocket	1924	25,000	66	60	Steel towers	2	11.97
	The Connecticut Power Co.							
51	Falls Village—New York State Line	1926	20,000	66	60	Steel towers	(ult. 2)	14.25
	The Connecticut Light & Power Co.							
52	Rocky River—Bunker Hill	1918	25,000	66	60	Steel towers	2	26.80
53	Stevenson—Bunker Hill	1919	20,000	66	60	Steel towers	1 (ult. 2)	13.32
54	Devon—Bunker Hill	1923	25,000	66	60	Steel towers	2	26.05
55	Bunker Hill—Southington	1923	20,000	66	60	Steel towers	2	13.83
56	Bunker Hill—Waterbury	1923	20,000	66	60	Steel towers	2	2.04
57	Southington—New Britain	1923	20,000	66	60	Steel towers	2	6.23
58	Southington—Meriden	1923	25,000	66	60	Steel towers	2	5.94
59	Devon—Meriden	1928	25,000	66	60	Steel towers	1 (ult. 2)	30.64
60	Meriden—Montville	1928	25,000	66	60	Wood poles	1	45.28
61	Derby—Devon Line	1923	20,000	66	60	Steel towers	2	1.46
62	Devon—Norwalk	1923	20,000	66	60	Steel towers	2	29.29
63	New Britain—Conn. Power Co. Line	1926	20,000	66	60	Steel towers	2	1.17
64	New Britain—Farmington R. Power Co.	1926	20,000	66	60	Wood poles	1	.43
	Danbury and Bethel Gas & Electric Light Co.							
65	Stevenson—Danbury	1930	11,000	66	60	Wood poles	1	10.6
	MIDDLE ATLANTIC							
	Mohawk Hudson Power Corp. (N. Y. Power & Light Corp.)							
1	Menands—Greenbush Tap—Mass. State Line	1923	60,000	110	60	Wood poles	1	17.64
2	Menands—Greenbush	1927	75,000	110	60	Steel towers	2	7.19
3	Rotterdam—Menands	1923	60,000	110	60	Steel towers	2	19.5
4	Sherman Island—Rotterdam	1923	100,000	110	60	Steel towers	2	56.6
5	Rotterdam—General Electric Co.	1921	75,000	110	60	Steel towers	2	2.4
6	Rotterdam—South Bethlehem	1923	50,000	66	60	Steel towers	2	22.67
7	Oneida—Sullivan Town Line	1925	40,000	110	60	Steel towers	1	9.4
8	Deerfield—Oneida	1925	40,000	110	60	Steel towers	1	21.5
9	Inghams—Deerfield	1926	40,000	110	60	Steel towers	1	25.4
10	Inghams—Little Falls	1918	15,000	66	60	Wood poles	1	9.58
11	Sprite Creek—Inghams	1923	10,000	66	60	Wood poles	1	7.28
12	Amsterdam Steam Plant—Inghams	1918	15,000	66	60	Wood poles	1	36.77
13	Amsterdam—Inghams	1921	30,000	66	60	Steel towers	2	36.5
14	Rotterdam—Amsterdam	1921	60,000	66	60	Steel towers	2	10.09
15	Hudson—Hudson River	1921	50,000	66	60	Steel towers	2	3.76
16	River Junction—Church St.	1927	20,000	66	60	Steel towers	1	1.29
17	Beardslee—Springfield Town Line	1924	10,000	66	60	Wood poles	1	10.80
18	Inghams—Beardslee	1924	15,000	66	60	Steel poles	1	3.34
	(Utica Gas & Electric Co.)							
19	Deerfield—Boonville	1923	60,000	110	60	Steel towers	2	26.9
20	Utica Gas & Electric Switchyard—N. Y. Power & Light Switchyard	1925	20,000	66	60	Wood poles	1	1,665 feet
	(The Syracuse Lighting Co., Inc.)							
21	Teall Avenue Substation	1925	.....	110	60	Steel towers	2	2
	Buffalo, Niagara & Eastern Power Corp. (Niagara, Lockport & Ontario Power Co.)							
22	Lockport—Mortimer	(1)	.....	110	60	Steel towers	(2)	56
23	Mortimer—Fairport Junction	(3)	.....	110	60	Steel towers	(2)	11
24	Fairport Junction to North Syracuse	(4)	.....	110	60	Steel towers	2	77
25	Salmon River—Syracuse Lighting Co. at North Syracuse	1925	.....	110	60	Steel towers	2	33
26	North Syracuse—Sullivan (Adirondack Power Corp.)	1925	.....	110	60	Steel towers	1 (ult. 2)	17
27	Lockport—Gardenville	(5)	.....	110	60	Steel towers	1	21
28	Gardenville—Olean	(6)	.....	110	60	Steel towers	(2)	67
29	Olean—Falconer (near Jamestown)	1927	.....	110	60	Steel towers	(2)	42
	Northern N. Y. Utilities Inc.							
30	Oswego—Altmar	1927	50,000	110	60	Steel towers	1	28.0
31	Boonville—Rome	1925	100,000	110	60	Steel towers	2	22.69
32	Lowville—Boonville	1923	100,000	110	60	Steel towers	2	22.72
33	Taylorville—Lowville	1920	100,000	110	60	Steel towers	2	12.35
34	Flat Rock—Higley Falls	1927	50,000	110	60	Steel towers	1	25.21
35	Brown Falls—Flat Rock	1924	50,000	110	60	Steel towers	1	1.46
36	Taylorville—Brown Falls	1923	100,000	110	60	Steel towers	2	28.11
37	Taylorville—Soft Maple	1925	100,000	110	60	Steel towers	2	4.51
38	Black River—Altmar	1925	100,000	110	60	Steel towers	2	35.66
39	Black River—Taylorville	1926	100,000	110	60	Steel towers	2	25.87
40	Norwood—Norfolk—Raymondville	1927	50,000	88	60	Steel towers	1	4.31
	Central Hudson Gas & Electric Corp.							
41	Poughkeepsie—Falls Village, Conn.	1927	15,000	110(7)	60	Steel towers	1 (ult. 2)	37 (8)
42	Poughkeepsie—Athens	1918	60,000	66	60	Steel towers	2	46.45
43	Catskill—Rotterdam	1922	22,000	110(7)	60	Steel towers	2	45
44	Ohioville—East Walden	1924	20,000	66	60	Steel towers	2	13
45	East Walden—West Bainville	1925	25,000	66	60	Steel towers	2	8.6
46	East Walden & West Wharton, N. J.	1926	30,000	110	60	Steel towers	2	58
47	West Bainville—Highland	1928	15,000	66	60	Wood poles	1 (ult. 2)	13.4
48	Sturgeon Pool—High Falls	1924	5,000	66(10)	60	Wood poles	1	4.2

etails of Transmission Lines in

Data on 877 High-Tension Lin

Structures					Conductors					
Weight of Steel per Tower, Lb. (10)	Number of Towers or Poles per Mile (11)	Type of Tower (12)	Manufacturer of Tower (13)	Material (14)	Cross Section Area, Circular Mils or Guage No. (15)	Spacing, Inches (16)	Clearance to Ground Minimum Feet (17)	Clearance to Towers Minimum Inches (18)	Normal Span Feet (19)
	13	H-frame		A.C.S.R.	211,600	150	22½	48	400
	13	H-frame		A.C.S.R.	266,800	150	22½	48	400
	16	Engineering standards B		A.C.S.R.	168,100	108 h.; 84 v.	20	30	300
1,200	16	A-frame	Archbold-Brady	A.C.S.R.	105,625	72	20	24	300
	16	Engineering standards B		A.C.S.R.	211,600	108 h.; 84 v.	20	30	300
	13	H-frame		A.C.S.R.	211,600	150	22½	48	400
	25			Al.	No. 0	72	25		200
	20			Cu.	No. 4	108	25		250
	13	Double circuit bayonet	American Bridge	Cu.	133,079	72	21	30	400
	26	Wishbone poles (2 lines)		Cu.	66,373	72	22	30	200
	15	H-frame		Cu.	83,694	72	21	30	
	6.3	Double circuit horizontal	American Bridge	Cu.	211,600	144 and 156	24	36	850
	26			Cu.	66,373	72	21		200
	8.5	Single circuit semi-flexible	American Bridge	Cu.	211,600, 300,000	162	24	42	625
	31			Cu.	66,373	72	21	30	200
	13	Double circuit bayonet	American Bridge	Cu.	66,373	72	21	30	400
	35			Cu.	41,742	72	21	30	150
	29			Cu.	66,373	72	21	30	200
	13	Double circuit bayonet	American Bridge	Cu.	133,079	72	21	30	400
	13	A-frame	American Bridge	Cu.	133,079	72	21	30	400
	26	Wishbone poles		Cu.	83,694	72	21	30	200
	7.6	Double circuit horizontal	American Bridge	Cu.	211,600	144 and 156	24	42	700
	10	Square double circuit vertical	American Bridge	Cu.	133,079	120	21	30	540
	8.5	Single circuit semi-flexible (2 lines)	American Bridge	Cu.	211,600	162	24	42	600
	10	Square double circuit	American Bridge	Cu.	133,079	120	21	42	580
	10	Square double circuit vertical	Milliken	Cu.	83,694	120	21	30	580
	16	H-frame		Cu.	6 mi. 66,373; 8.3 mi. 133,079	102	21	30	550
	13	A-frame	American Bridge	Cu.	83,694	72	21	30	400
	26	Wishbone poles		A.C.S.R.	66,373 equivalent	72	21	30	200
	13	H-frame		Cu.	211,600	150	24	42	400
	13¼	H-frame		Cu.	211,600	150	24	42	400
	10	Square double circuit vertical	American Bridge	Cu.	83,694	120	21	30	580
	13	H-frame		Cu.	211,600	150	24	42	400
	13	Semi-flexible double circuit	American Bridge	Cu.	66,373	72	21	30	400
	26			Cu.	83,694	72	21	30	200
	26	Wishbone poles		Cu.	66,373	72	22	30	200
	10	Square double circuit vertical	American Bridge	Cu.	133,079	120	21	30	580
	26	Wishbone poles		Cu.	105,534	72	21	30	200
	14	H-frame (2 lines)		Cu.	133,079	120	24	36	550
	10	Square double circuit vertical	Milliken, American Bridge	Cu.‖	3 mi. No. 0; 2 mi. No. 00	⅝	22	30	530
10,000; 15,000	7	Double circuit vertical	Blaw-Knox	Cu.	211,600	132	22	54	750
5,110	8	Standard suspension	Lehigh Str. Co.	Cu.	133,000	120	28	30	600
	36			Cu.	41,600	72	30		150
	8.8	Standard 75′ Milliken	Milliken	M.h.d. Cu.	105,500	98	22	48	600
5,077	9	4 posted square semi-rigid	Milliken, Aermotor	7 strand Cu.	105,500	96	20	30	550
3,778 with stubs	9	4 posted square semi-rigid	Milliken	7 strand Cu.	133,100	120	20	30	550
4,000	9	4 posted square semi-rigid	Milliken	7 strand Cu.	105,500	108	20	30	550
Standard 4,500	13	4 posted square semi-rigid	Milliken	A.C.S.R.	211,600	120	20	30	600
	9	4 posted square	U. S. Wind Pump & Engine	Cu.	66,370	84	20		440
4,850; 6,300	9	Square	Bancroft-Jones	H.d. Cu.	133,100	96—120	25	70	500
8,419; 13,110	8	Suspension and strain	Blaw-Knox	A.C.S.R.	211,600	120; (234 hor.)	25	42	850
6,500	7	Four-legged	Riter-Conley	Cu.	211,600	96	24	29	750
4,900	10½	Four-legged	Blaw-Knox	Cu.	133,100	96	24	29	500
6,260	7½	Four-legged	Blaw-Knox	Cu.	211,600	96	24	29	700
6,260	8	Four-legged	Blaw-Knox	Cu.	133,100	96	24	29	650
5,000	13	Four-legged	Blaw-Knox	Cu.	133,100	96	24	29	400
6,260	8	Four-legged	Blaw-Knox	Cu.	133,100	96	24	29	650
6,260	7½	Four-legged	Blaw-Knox	Cu.	211,600	96	24	29	700
6,860	7	Four-legged	Riter-Conley	Cu.	211,600	96	24	29	750
	7½	H-frame and single poles		Cu.	211,600	156	27	42	700
6,260	8	Four-legged	Blaw-Knox	Cu.	133,100	96	24	29	650
2,600 and 4,100	12	Flexible frame and four-legged	Blaw-Knox	A.C.S.R. and Cu.	133,079	84	24	29	450
6,470	9	Four-legged	Blaw-Knox	Cu.	133,100	120	26	42	600
	40	Single poles	Chestnut	Cu.	123,100	72	27	32	125
	21			H.d. Cu.	66,373	72			250
	14			Cu.	211,600	150	24	70	375
4,643; 12,119	7.2	A-frame and square	Archbold-Brady	Cu.	211,600	108	24	78	600
8,700	8	Square	Riter-Conley	Cu.	211,600	116	24	75	660
8,078	8	Square	Riter-Conley	Cu.	211,600	114	24	75	660
4,264; 13,139	8.8	A-frame and square		Cu.	211,600	115	24	75	600
8,078	8	Square	Riter-Conley	Cu.	211,600	114	24	75	660
4,243; 12,119	8.8	A-frame and square	Archbold-Brady	Cu.	211,600	108	24	78	600
4,643; 12,119	8.8	A- frame and square	Archbold-Brady	Cu.	211,600	105	24	78	600
4,643; 12,119	8.8	A-frame and square	Archbold-Brady	Cu.	211,600	108	24	78	600
	17.6			Cu.	167,800	70			300
	22.6			Cu.	66,370	84	21	55	300
	17.6			Cu.	167,800; 3 mi., 211,600	70			300
	8.8	A-frame and square		Cu.	66,370; 7.5 mi., 211,600	84	24	50	600
4,264; 13,139	8.8	A-frame and square	Archbold-Brady	Cu.	211,600	84	24	50	600
	8.8	Square	Riter-Conley	Cu.	105,500	86	22	75	600
	8.8	Square		Cu.	211,600	84	22		600
	13.3			Cu.	211,600	150	24	70	375
4,264; 13,139	8.8	A-frame and square	Riter-Conley	Cu.	133,100	108	24	78	600
7,250	8	50 feet l'ced channel	Archbold-Brady	M.h.d. Cu.	212,000	120	25	48	545
	45			Cu.	212,000	90	25	36	115
Ave. 3,396	10	Flex. A-frame; dead end	Archbold-Brady	7 strand m.h.d. Cu.	211,600	150, 142, 243	37	60	600
4,100; 12,500	10	Flexible and square	A.-B. and R.-C.	A.C.S.R.	397,500	111, 96	25		550
7,300	10	3-circ. flexible and square	Archbold-Brady	Cu.	300,000	120, 110	25		550
4,600; 12,500	10	Flexible and rigid	American Bridge and R.-C.	34 mi. Cu., 43 mi. A.C.S.R.	300,000; 477,000	117, 99	25	When insulator is at 45° from vertical	550
4,100; 12,500	11	Flexible and rigid	A.-B. and R.-C.	Cu.	211,600	115, 96	25		530
4,100; 12,500	9	Flexible and rigid	B.-J., A.-B., R.-C.	Cu.	211,600	(*)	25		600
3,500	10	Old square pin type remodeled	Aermotor	Cu.	250,000	160 hor.; 99 vert.	25		550
4,700; 12,500	19	Flexible and rigid	B.-J., Lacka., R.-C.	A.C.S.R.	336,400	115, 96	25		600
4,600; 12,500	10	Flexible and rigid	American Bridge, R.-C.	A.C.S.R.	336,400	117, 99	25		600
4,014; 8,210	9	Channel and strain	Archbold-Brady	Cu.	211,600	120	25	34	660
4,014; 8,210	9	Channel and strain	Archbold-Brady	Cu.	211,600	120	25	34	660
4,014; 8,210	8	Channel and strain	Archbold-Brady	Cu.	211,600	120	25	34	660
	9	Square	Milliken	Cu.	211,600	120	25	34	660
4,014; 8,210	9	Channel and strain	Archbold-Brady	Al.†	336,400	120	25	34	660
4,014; 8,210	9	Channel and strain	Archbold-Brady	Cu.	211,600	120	25	34	660
4,014; 8,210	8	Channel and strain	Archbold-Brady	Cu.	211,600	120	25	34	660
4,014; 8,210	8.5	Channel and strain	Archbold-Brady	Cu.	211,600	120	25	34	660
4,014; 8,210	9	Channel and strain	Archbold-Brady	Cu.	211,600	120	25	34	660
4,014; 8,210	9	Channel and strain	Archbold-Brady	Cu.	211,600	120	25	34	660
4,014; 8,210	14	Channel and strain	Archbold-Brady	Cu.	211,600	120	25	34	660
6,925; 12,050 (*); 13,753-21,669	11.5, 16.5	Square base	B.-K., Lehigh	5 mi. Cu.; 17.4 mi. A.C.S.R.	Cu. No. 4-0; A.C.S.R. 4-0	120	Pole 18; t'r 25	42	300; 500; 650
3,800	10	Square base	Riter-Conley	7 strand h.d. Cu.	105,500	90	25	30	500
7,200 (*); 11,175	8	Square base	Archbold-Brady	7 strand h.d. Cu.	211,600	114	25	42	660
6,400; 9,000	8.33	Square base	Riter-Conley	7 strand h.d. Cu.	211,600	114	25	42	660
4,653; 5,765	10.4	Square base	Riter-Conley	7 strand Cu.	105,500	90	23	30	500
6,230; 6,855; 8,980	7.65	Square base	R.-C.; Lehigh	A.C.S.R.	No. 0000	120	25	42	700
	22			7 strand Cu.	105,500	72	20	30	250
	28			7 strand h.d. Cu.	105,500	108	22	30	260

Supplement to ELECTRICAL WORLD, September 21, 1929

SEP 23

hes in the United States Opera

-Tension Lines Covering 23,674 Miles, Showing Current Practice

Compiled by ELECTRICAL WORLD

Conductors						Insulation							
							Tangent Line				At Angle Towers		
rance to Ground inimum Feet (17)	Clearance to Towers Minimum Inches (18)	Normal Span Feet (19)	Normal Sag Feet (20)	Normal Stringing Tension, Lb. (21)	Vertical or Horizontal Arrangement (22)	Normal Volts (23)	No. of Units (24)	Type (25)	Manufacturer (26)	No. of Units (27)	Type (28)	Manufacturer (29)	Ne
22¾	48	400	5	1,150	Horizontal	73,000	5	Socket suspension	Ohio Brass; Locke	9	Socket suspension	O. B.; Locke	....
22¾	48	400	6'10"	950	Horizontal	73,000	5	Suspension	Locke	9	Suspension	Locke	....
20	30	300	2'7"	1,000	△	73,000	5	Suspension	Locke	6	Suspension	Locke	....
20	24	300	3'4"	800	Vertical	73,000	1	Pin	Victor	2	.....	Victor	....
20	30	300	2'9"	1,200	△	73,000	5	Hewlett	Thomas	6	Hewlett	Thomas	
23¾	48	400	5	1,150	Horizontal	73,000	5	Hewlett suspension	Thomas	9	Hewlett suspension	Thomas	....
25	.....	200	.....	.....	△	66,000	4	D	Ohio Brass	5	D	Ohio Brass	
25	.....	250	.....	.....	Horizontal	66,000	4	D	Ohio Brass	5	D	Ohio Brass	
21	30	400	13	.....	△△	.....	.....	Pin	Locke	5	10" disc	Locke	....
22	30	200	3.3	.....	▷	.....	4	10" disc.	Locke	5	10" disc	.....	
21	30	.....	10	.....	△△	.....	.....	Pin	Locke	5	10" disc	Locke	
24	36	850	32	.....	Horizontal	.....	8	10" disc. B. & S.	Locke	9	10" disc B. & S.	.....	
21	.....	200	3.3	.....	▷	.....	4	10" disc.	Locke	5	10" disc	.....	
24	42	625	20	.....	Horizontal	.....	8, 9	10" disc	Ohio Brass; Locke	9	10" disc	.....	Ext
21	30	250	3.3	.....	△	.....	.....	Pin	Locke	5	10" disc	Locke	....
21	30	400	13	.....	△△	.....	.....	Pin	Locke	5	10" disc	Locke	
21	30	150	2	.....	▷	.....	.....	Pin	Locke	5	10" disc	Locke	....
21	30	200	3.3	.....	△	.....	.....	Pin	Locke	5	10" disc	Locke	
21	30	400	13	.....	△△	.....	.....	Pin	Locke	5	10" disc	Locke	
21	30	400	13	.....	Vertical	.....	.....	Pin	Locke	5	10" disc	Locke	
21	30	200	3.3	.....	▷	.....	4	10" disc	Locke	5	10" disc	.....	
24	42	700	25	.....	Horizontal	.....	10/9/8/8/9/10	10" disc	Ohio Brass	.....	.....	.....	Ext
21	30	580	19	.....	Vertical	.....	6	10" disc	Locke	7	10" disc	.....	
24	42	600	14	.....	Horizontal	.....	8; 9/8/9	10" disc	W'hse; Locke	9; 9/8/9	10" disc	.....	
21	42	580	19	.....	Vertical	.....	6	10" disc	Locke	7	10" disc	.....	
21	30	580	19	.....	Vertical	.....	4	10" disc	Locke	7	10" disc	.....	
21	30	350	10	.....	Horizontal	.....	5	10" disc	Ohio Brass	6	10" disc	.....	
21	30	400	13	.....	Vertical	.....	.....	Pin	Locke	.....	.....	.....	
21	30	200	3.3	.....	▷	.....	4	10" disc	Locke	5	10" disc	.....	
24	42	400	10	.....	Horizontal	.....	8	10" disc	Ohio Brass	9	10" disc	.....	
24	42	400	10	.....	Horizontal	.....	8	10" disc	Ohio Brass	9	10" disc	.....	
21	30	580	19	.....	Vertical	.....	5	10" disc	Locke	5	10" disc	.....	
24	42	400	10	.....	Horizontal	.....	8	10" disc	Ohio Brass	9	10" disc	.....	
21	30	400	13	.....	Vertical	.....	4	10" disc	Locke	5	10" disc	.....	
21	30	200	3.3	.....	▷	.....	4	10" disc	Ohio Brass	5	10" disc	.....	
22	30	200	3.3	.....	▷	.....	4	10" disc	Locke	5	10" disc	.....	
21	30	580	19	.....	Vertical	.....	6	10" disc	Locke	7	10" disc	.....	
21	30	200	3.3	.....	▷	.....	4	10" disc	Thomas	5	10" disc	.....	
24	36	350	10	.....	Horizontal	.....	5	10" disc	Ohio Brass	6	10" disc	.....	
22	30	590	16	.....	Vertical	.....	5	10" disc	Thomas, Ohio B.	6	10" disc	.....	
22	54	750	30	1,600	Vertical	300,000	8	Suspension	Locke	10	Suspension	Locke	
28	50	600	16	Standard sagging tables	Vertical	66,000	5	10" disc	Locke; Ohio Brass	6	10" disc	Locke, O. B.	
30	.....	150	.....	.....	△	.....	.....	Pin	.....	.....	.....	.....	
22	48	600	23	.....	Vertical	66,000	5	No. 1142	Thomas	6	No. 1,142	Thomas	
20	30	550	17.3	800	Vertical	66,000	4	Hewlett	Thomas	5	Hewlett	Thomas	....
20	30	550	14	1,025	Vertical	110,000	6	Hewlett	Thomas	7	Hewlett	Thomas	
20	30	550	17.3	800	Vertical	66,000	4	Hewlett	Thomas	5	Hewlett	Thomas	....
20	30	600	6.8	2,000	Vertical	110,000	6	Metal cap No. 25,620	Ohio Brass	7	Metal cap	Ohio Brass	
20	.....	440	16.3	300	△	66,000	1	Pin	Thomas	1	.....	.....	
28	70	500	11.5	1,100	Vertical	66,000	5	10" disc	Locke	6	10" disc	Locke	
25	42	850	For "B" load	4,050	Vertical	550,000	8	No. 8,400 b. s. suspension	Locke	9	No. 8,400 b. s. str.	Locke	
24	29	750	23	2,000	Vertical	66,000	5	Ball and socket	Ohio Brass	5	Ball and socket	Ohio Brass	
24	29	500	12	1,040	Vertical	66,000	5	Jeffery-Dewitt	Jeffery-Dewitt	5	Jeffery-Dewitt	Jeffery-Dewitt	
24	29	700	20	2,000	Vertical	66,000	5	Jeffery-Dewitt	Jeffery-Dewitt	5	Jeffery-Dewitt	Jeffery-Dewitt	
24	29	650	19	1,040	Vertical	66,000	5	Jeffery-Dewitt	Jeffery-Dewitt	5	Jeffery-Dewitt	Jeffery-Dewitt	
24	29	400	7	1,040	Vertical	66,000	5	Jeffery-Dewitt	Jeffery-Dewitt	5	Jeffery-Dewitt	Jeffery-Dewitt	
24	29	650	19	1,040	Vertical	66,000	5	Jeffery-Dewitt	Jeffery-Dewitt	5	Jeffery-Dewitt	Jeffery-Dewitt	
24	29	700	20	2,000	Vertical	66,000	5	Jeffery-Dewitt	Jeffery-Dewitt	5	Jeffery-Dewitt	Jeffery-Dewitt	
24	29	750	20	2,000	Vertical	66,000	5	Ball and socket	Locke	5	Cap and pin	Locke	
27	42	700	20	2,000	Horizontal	66,000	6	Cap and pin	Westinghouse	6	Cap and pin	Westinghouse	
24	29	650	19	1,040	Vertical	66,000	5	Jeffery-Dewitt	Jeffery-Dewitt	5	Jeffery-Dewitt	Jeffery-Dewitt	
24	29	450	9	500—1,040	Vertical	66,000	5	Jeffery-Dewitt	Jeffery-Dewitt	5	Jeffery-Dewitt	Jeffery-Dewitt	
26	42	600	15	1,040	Vertical	110,000	7	Hewlett	Thomas	7	Hewlett	Thomas	
27	32	125	1	1,700	△	66,000	1	Pin	Locke	1	Pin	Locke	
.....	.....	250	1.7	90	▷	66,000	.....	.....	.....	.....	.....	.....	
24	70	375	8	Maximum 3,200	Horizontal	110,000	8	Suspension	Locke	9	Strain	Locke	
24	78	600	16.7	Maximum 4,000	Vertical	110,000	8	Suspension	Locke	9	Strain	Locke	
24	75	660	20.2	Maximum 4,000	Vertical	110,000	8	Suspension	Locke	9	Strain	Locke	
24	75	660	20.2	Maximum 4,000	Vertical	110,000	8	Suspension	Locke	9	Strain	Locke	....
24	75	600	16.7	Maximum 4,000	Vertical	110,000	8	Suspension	Locke	9	Strain	Locke	
24	75	660	20.2	Maximum 4,000	Vertical	110,000	8	Suspension	Locke	9	Strain	Locke	6 su
24	78	600	16.7	Maximum 4,000	Vertical	110,000	8	Suspension	Locke	9	Strain	Locke	....
24	78	600	16.7	Maximum 4,000	Vertical	110,000	8	Suspension	Locke	9	Strain	Locke	....
24	78	600	16.7	Maximum 4,000	Vertical	110,000	8	Suspension	Locke	9	Strain	Locke	....
.....	.....	300	.....	.....	△	66,000	1	Pin	.....	1	Strain	Locke	....
21	55	300	4.8	Maximum 1,520	Vertical	66,000	6	Suspension	Locke	7	Strain	Locke	....
.....	.....	300	.....	.....	△	66,000	1	Pin	.....	1	Strain	Locke	....
24	50	600	.....	.....	Vertical	66,000	1, 6	29 mi. pin; 7 mi. susp.	(Susp.) Locke	2, 7	Suspension	Locke	....
24	50	600	16.7	Maximum 5,000	Vertical	66,000	6	Suspension	Locke	7	Suspension	Locke	
22	75	600	.....	.....	Vertical	66,000	5	Suspension	Hewlett	6	Strain	Hewlett	
22	.....	600	16.7	.....	Vertical	66,000	6	Suspension	.....	7	Strain	.....	
24	70	375	8	Maximum 3,200	Horizontal	110,000	8	Suspension	Locke	9	Strain	Locke	
24	78	600	16.3	Maximum 3,060	Vertical	110,000	8	Suspension	Locke	9	Strain	Locke	
25	48	545	16	3,000	Vertical	110,000	8	Hewlett 10"	Thomas	10	Hewlett 10"	Thomas	
25	36	115	1.6	2,500	△	66,000	4	Hewlett 10"	Thomas	5	Hewlett 10"	Thomas	
37	60	600	11	1,500	Vertical	132,000	7	No. 257	Jeffery-Dewitt	9	Ohio Brass No. 26,731	Ohio Brass	
25	When insulator is at 45° from vertical: 36	550	14	1,700	Vertical	110,000	7	Core and tine	Jeffery-Dewitt	9	Cap and pin	Lapp	
25	36	550	14	2,500	Vertical	110,000	7	Core and tine	Jeffery-Dewitt	2x9	Core and tine	Jeffery-Dewitt	
25	36	550	14.5	2,400; A.C.S.R. 1,660	Vertical	110,000	7	Core and tine	Jeffery-Dewitt	2x9	Core and tine	Jeffery-Dewitt	
25	36	530	10	2,300	Vertical	110,000	7	Core and tine	Jeffery-Dewitt	9	Cap and pin	Ohio Brass	
25	36	600	13	2,200	△	110,000	7	Core and tine	Jeffery-Dewitt	9	Cap and pin	Ohio Brass	
25	30	550	12.5	2,350	△	110,000	7	Cap and pin	Ohio Brass	9	Cap and pin	Ohio Brass	
25	36	600	15	1,600	Vertical	110,000	7	Core and tine	Jeffery-Dewitt	2x8	Core and tine	Jeffery-Dewitt	
25	36	600	15	1,600	Vertical	110,000	7	Core and tine	Jeffery-Dewitt	2x9	Core and tine	Jeffery-Dewitt	
25	34	660	21	1,350	Vertical	110,000	6 or 7	Hewlett	Thomas	7 or 8	Hewlett	Thomas	
25	34	660	21	1,350	Vertical	110,000	6 or 7	Hewlett	Thomas	7 or 8	Hewlett	Thomas	
25	34	660	21	1,350	Vertical	110,000	6 or 7	Hewlett	Thomas	7 or 8	Hewlett	Thomas	
25	34	660	21	1,350	Vertical	110,000	6 or 7	Hewlett	Thomas	7 or 8	Hewlett	Thomas	
25	34	660	21	1,350	Vertical	110,000	6 or 7	Hewlett	Thomas	7 or 8	Hewlett	Thomas	
25	34	660	21	1,350	Vertical	110,000	6 or 7	Hewlett	Thomas	7 or 8	Hewlett	Thomas	
25	34	660	21	1,350	Vertical	110,000	6 or 7	Hewlett	Thomas	7 or 8	Hewlett	Thomas	
25	34	660	21	1,350	Vertical	110,000	6 or 7	Hewlett	Thomas	7 or 8	Hewlett	Thomas	
25	34	660	21	1,350	Vertical	110,000	6 or 7	Hewlett	Thomas	7 or 8	Hewlett	Thomas	
le 18; t'r 25	42	300; 500; 650	4; 4; 8.5 Cu.	1,800; A.C.S.R. 2,000	Vertical	110,000	8	Cap and pin No. 8,400	Locke	9	Cap and pin No. 8,400	Locke	
25	30	500	14	720; 2,500 maximum	Vertical	66,000	5	Cap and pin	Locke	6	Cap and pin	Locke	
25	42	660	16.5	2,100; 5,000 maximum	Vertical	110,000	8	Cap and pin	Locke	9	Cap and pin	Locke	
25	42	660	16.5	2,100; 5,000 maximum	Vertical	110,000	8	Jeffery-Dewitt No. A-257	Jeffery-Dewitt	9	Jeffery-Dewitt No. A-257	Jeffery-Dewitt	5 su
25	30	500	14	720; 2,500 maximum	Vertical	66,000	5	Jeffery-Dewitt No. A-257	Jeffery-Dewitt	6	Jeffery-Dewitt No. A-257	Jeffery-Dewitt	
25	42	700	11	1,600; 5,000 maximum	Vertical	110,000	8	Hewlett link No. 11,029	Thomas	2x9	Hewlett link No. 11,029	Thomas	
20	30	250	4	600; 2,000 maximum	Vertical	66,000	3	Jeffery-Dewitt	Jeffery-Dewitt	5	Jeffery-Dewitt	Jeffery-Dewitt	
22	30	260	2.8	950; 2,500 maximum	Vertical	66,000	4	Jeffery-Dewitt No. A-257	Jeffery-Dewitt	4	Jeffery-Dewitt No. A-257	Jeffery-Dewitt	
20	34	400	9	3,200 winter	Horizontal	110,000	8	Suspension disc	Locke No. 5,000	9	Suspension disc	Locke No. 5,000	

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ating At or Above 66,000 Vol

	End Insulation		Conductor and Insulator Protection								Arresters		Overhead Ground	
	Reduced Near Stations (30)	No. of Units (31)	Arcing Horns, Type (32)	Arcing Rings (33)	Size, Inches Top (34)	Size, Inches Bottom (35)	Conductor Clamps, Type and Size (36)	Splicing Method (37)	Type (38)	Manufacturer (39)	Material (40)	Size Inches (41)
			None	None			Ohio Brass suspension, 9¾"	Aluminum Co. twist joints	L. V.	W'hse		
			None	None			4 bolt suspension, 9"	Compression joint	Oxide film	G. E.	None	
			None	None			4 bolt suspension, 9"	Parallel sleeve	Oxide film	G. E.	None	
			None	None			Tie wire	Parallel sleeve	Oxide film	G. E.	Steel	¼
	At subs.	1	Thomas spoon	None			Link suspension, 8"	Aluminum Co. twist joint	Oxide film	G. E.	Crucible steel	⅜
			Thomas spoon	None			Thomas suspension, 8"	Aluminum Co. twist joint	Oxide film	G. E.	S.-M. galvanised steel	3/16
	No		None	None				Sleeves	Aluminum cell at Bennington	G. E.	None	
	No		None	None			Ohio Brass No. 11,352	Sleeves	None		None	
			None	None				Twist sleeve	Yes		Cu.	No. 2
	No		None	None				Twist sleeve	Yes		None	
	No		None	None				Twist sleeve	Yes		None	
	No		Yes					Twist sleeve	Yes		Galvanised steel	3/16
	No		None	None				Twist sleeve	Yes		None	
Extra gr. wires	7		24" flat, 1st circuit	2nd circ.	15x30	15x30		No. 1, twist sleeve; No. 2 compr.	Yes		Galvanised steel	3/16
			None	None				Twist sleeve	Yes		None	
	No		None	None				Twist sleeve	Yes		Cu.	No. 2
			None	None				Twist sleeve	Yes		Cu.—clad	No. 6
	No		None	None				Twist sleeve	Yes		None	
	No		None	None				Twist sleeve	Yes		Cu.	No. 2
	No		None	None				Twist sleeve	Yes		Cu.—clad	⅛
	No		None	None				Twist sleeve	Yes		None	
Extra gr. wires				Yes	15x30	15x30		Twist sleeve	Yes		Galvanised steel	3/16
	No		Only in R. I. 15"					Twist sleeve	Yes		Galvanised steel	3/16
	Yes	7	24" flat 1st circuit	2nd circ.	15x30	15x30		Twist sleeve	Yes		Galvanised steel	3/16, 7/16
			None	None				Twist sleeve	Yes		Galvanised steel	⅜
	No		None	None				Twist sleeve	Yes		Galvanised steel	3/16
	No		None	None				Twist sleeve	Yes		Galvanised steel	3/16
	No		None	None				Twist sleeve	Yes		Cu.-clad	⅛
	No		None	None				Twist sleeve	Yes		None	
	No		None	None				Twist sleeve	Yes		None	
	No		None	None				Twist sleeve	Yes		None	
	No		None	None				Twist sleeve	Yes		Galvanised steel	3/16
	No		None	None				Twist sleeve	Yes		None	
	No		None	None				Twist sleeve	Yes		Galvanised steel	3/16
	No		None	None				Twist sleeve			None	
	No		None	None				Twist sleeve			None	
	No		None	None				Twist sleeve			Galvanised steel	3/16
	No		None	None				Twist sleeve			None	
	No		None	None				Twist sleeve			None	
	No		None	None				Twist sleeve			Galvanised steel	3/16
	No		Locke 30" spread		Horns	30"	Locke No. 4,658 and No. 11,950	19¼" Cu. sleeves	None		S.-M. stranded steel	3/16 dia.
	No		15"	None			2-bolt suspension, No. 2/0 wire	Sleeve	A' terminals, oxide film	G. E.	Stranded steel	3/16
									Electro		Cu.-clad	No. 6
	No		None	None				Sleeve	At terminals, Aluminum	G. E.	7-str. galvanised steel	3/16, 7 str.
			Own, Thomas, V. S.				S. & P. No. 103, 6 bolt	Cu. sleeve	Aluminum cell	G. E.	Galvanised steel	3/16
	No		Thomas, V. S.				S. & P. No. 103, 6 bolt	Cu. sleeve	Aluminum cell	G. E.	Galvanised steel	3/16
			Own, Thomas, V. S.	None			S. & P., 6 bolt	Cu. splice sleeve	Aluminum cell	G. E.	Galvanised steel	3/16
	No		None						Aluminum cell		Galvanised steel	3/16
	No								Aluminum cell	G. E.	Galvanised steel	3/16
	No		Locke No. 5,029	None			Locke 5,147	Sleeve	None		S.-M. galvanised steel	3/16
	No		None	None			O. B. No. 72,366, No. 71,038, No. 71,042, No. 4/0		None		D'bie galv., high s. st'l	3/16
	No		Ohio Brass	None			Ohio Brass No. 11,351, No. 4/0	Sleeves	Bennett	El. Pr. Eq.	Copperweld	3/16
	No		Ohio Brass	None			Ohio Brass No. 11,351, No. 2/0	Sleeves	Oxide film	G. E.	Steel	⅜
	No		Ohio Brass	None			Ohio Brass No. 11,351, No. 4/0	Sleeves	Oxide film	G. E.	Copperweld	3/16
	No		Ohio Brass	None			Ohio Brass No. 11,351, No. 2/0	Sleeves	Oxide film	G. E.	Copperweld	3/16
	No		Ohio Brass	None			Ohio Brass No. 11,351, No. 2/0	Sleeves	Oxide film	G. E.	Copperweld	3/16
	No		Ohio Brass	None			Ohio Brass No. 11,351, No. 2/0	Sleeves	Auto-valve	W'hse	Copperweld	3/16
	No		Ohio Brass	None			Ohio Brass No. 11,351, No. 4/0	Sleeves	Auto-valve	W'hse	Copperweld	3/16
	No		None	None			Locke No. 15,075, No. 4/0	Sleeves	Auto-valve	W'hse	Copperweld	3/16
	No		None	None			Westinghouse, No. 4/0	Sleeves	Auto-valve	W'hse	None	
	No		Ohio Brass				Ohio Brass No. 11,551, No. 2/0	Sleeves	Oxide film	G. E.	Copperweld	No. 0
	No		Ohio Brass	None			Ohio Brass No. 11,551, No. 2/0	Sleeves	Oxide film	G. E.	Coppweld	3/16
	No		Thomas V.S.	None			Thomas, No. 2/0	Sleeves	Oxide film	G. E.	Copperweld	3/16
	No		None	None			Tie wire, No. 4 Cu.	Sleeves	Auto-valve	W'hse	None	
	No							Sleeves	Electrolytic	W'hse	Galv. steel stranded	3/16
	No							Sleeves	At sub., oxide film	G. E.		
	No		Lee clamps				Locke No. 8,476; Ohio Brass No. 91,950	Sleeves	At sub., oxide film	G. E.	Copperweld	3/16, 7 str.
	No								At sub., oxide film	G. E.	Copperweld	3/16, 7 str.
			Locke No. 4,694				Locke No. 3,032	Sleeves	At sub., oxide film	G. E.	Copperweld	3/16, 7 str.
	No								At sub., oxide film	G. E.	Siemens-Martin 7 str.	3/16
6 susp., 7 strain			Locke No. 4,694				Locke No. 3,032	Sleeves	At sub., oxide film	G. E.	Copperweld 7 str.	3/16
			Lee clamps	None			Locke No. 8,476; Ohio Brass No. 119,506	Sleeves	At sub., oxide film	G. E.	Copperweld	3/16, 7 str.
			Lee clamps				Locke No. 8,476; Ohio Brass No. 119,506	Sleeves	At sub., oxide film	G. E.	Copperweld	3/16, 7 str.
			Lee clamps	None			Locke No. 8,476; Ohio Brass No. 119,506	Sleeves	At sub., oxide film	G. E.	Copperweld	3/16, 7 str.
									At sub., oxide film	G. E.		
									At sub., oxide film	G. E.	Copperweld	3/16
									At sub., oxide film	G. E.		
	No								At sub., oxide film	G. E.	C. S.; S.-M. 7 str.	5/16; 3/16
	No								At sub., oxide film	G. E.	Siemens-Martin 7 str.	3/16
									At sub., oxide film	G. E.	C. S. stranded	5/16
									At sub., oxide film	G. E.	Siemens-Martin 7 str.	3/16
	No		Lee clamp				Locke No. 5,200; Ohio Brass No. 11,950	Sleeves	At sub., oxide film	G. E.		
			Lee clamp				Locke No. 5,169; Ohio Brass No. 11,947	Sleeves	At sub., oxide film	G. E.	Copperweld	3/16, 7 str.
	No		Thomas No. 5,482; No. 5,483	None			Thomas No. 10,009, No. 4/0	Cu. sleeves	None		S.-M. stranded steel	3/16
	No		None	None			Ohio Brass strain clamps, No. 4/0	Cu. sleeves	Oxide film	G. E.		
	No		None	None				McIntyre sleeves	None		Siemens-Martin steel.	3/16
	No		None	None			Malleable iron, to fit cable	2 pc. Aluminum compression joint	None		High str. cruc. st. galv.	3/16
	No		None	None			Malleable iron, to fit cable	Cu. twist sleeves	None		High str. cruc. st. galv.	3/16
	No		None	None			Malleable iron, to fit cable	Cu. twist sleeves	None		High str. cruc. st. galv.	3/16
	No		None	None			Malleable iron, to fit cable	Compr. joints A.C.S.R. twist sleeves	None		High str. cruc. st. galv.	3/16
	No		None	None			Malleable iron, to fit cable	Twist sleeves	None		High str. cruc. st. galv.	3/16
	No		None	None			Malleable iron, to fit cable	Twist sleeves	None		None	
	No		None	None			Malleable iron, to fit cable	2 pc. Aluminum compression joint	None		High str. cruc. st. galv.	3/16
	No		None	None			Malleable iron, to fit cable	Aluminum compression joints	None		High str. cruc. st. galv.	3/16
	No		Flat strap iron	None			Solid clamp, No. 4/0	Cu. sleeves	Oxide film	G. E.	Siemens-Martin galv.	3/16
	No		Small round horn	None			Solid clamp, No. 4/0	Cu. sleeves	None		Siemens-Martin galv.	3/16
	No		Small round horn	None			Solid clamp, No. 4/0	Cu. sleeves	None		Siemens-Martin galv.	3/16
	No		Small round horn	None			Solid clamp, No. 4/0	Cu. sleeves	None		Siemens-Martin galv.	3/16
	No		Thomas V. S.	None			Solid clamp, No. 4/0	Aluminum compression sleeves	None		Siemens-Martin galv.	3/16
	No		Small round horn	None			Solid clamp, No. 4/0	Cu. sleeves	None		Siemens-Martin galv.	3/16
	No		Small round horn	None			Solid clamp, No. 4/0	Cu. sleeves	None		Siemens-Martin galv.	3/16
	No		Small round horn	None			Solid clamp, No. 4/0	Cu. sleeves	None		Siemens-Martin galv.	3/16
	No		Small round horn	None			Solid clamp, No. 4/0	Cu. sleeves	None		Siemens-Martin galv.	3/16
	No		Small round horn	None			Solid clamp, No. 4/0	Cu. sleeves	None		Siemens-Martin galv.	3/16
	No		Thomas V. S.	None			Solid clamp, No. 4/0	Cu. sleeves	None		Siemens-Martin galv.	3/16
	No		Top only, No. 12,151	Bot. only			Locke 12,151; Ohio Brass susp. and strain, No. 4/0	Twist sleeves	Oxide film	G. E.	5-mi. Cu.-weld, bal.h.s.	3/16
	No			None			Ohio Brass suspension and strain, No. 1/0	Twist sleeves	Oxide film	G. E.	Copper-clad steel	5/16
5 susp. & 8 str.	for 5 turns)		Old standard	None			Ohio Brass suspension and strain, No. 4/0	Twist sleeves	Oxide film	G. E.	Copper-clad steel	3/16
	No		No	None			Ohio Brass suspension and strain, No. 4/0	Twist sleeves	Oxide film	G. E.	Str. high strength galv.	3/16
	No		None	1 circ.			Ohio Brass suspension and strain, No. 1/0	Twist sleeves	Oxide film	G. E.	S.-M. galv. steel	3/16
	No		Old standard	None			Ohio Brass susp. No. 71,038, str. No. 72,366, No. 4/0	Twist sleeves	Oxide film	G. E.	No ground wire	
	No		No	None			Ohio Brass suspension and strain, No. 1/0	Twist sleeves	Oxide film	G. E.	Galv. S.-M. stranded	3/16
	No		No				Ohio Brass suspension and strain, No. 1/0	Twist sleeves	Oxide film	G. E.	None	
			Ohio Brass No. 11,950	None			Suspension, Locke No. 5,200	Seamless Cu. sleeves	Aluminum cell	G. E.	None	

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d States Operating At or Abov

Showing Current Practice

Insulation														
Tangent Line				At Angle Towers		End Insulation		Arcing Horns, Type	Arcing Rings	Size, Inches		Conductor Clamps, Type and Size		
	Type (25)	Manufacturer (26)	No. of Units (27)	Type (28)	Manufacturer (29)	Reduced Near Stations (30)	No. of Units (31)	(32)	(33)	Top (34)	Bottom (35)	(36)		
	Socket suspension	Ohio Brass; Locke	9	Socket suspension	O. B.; Locke	.....	.....	None	None	.....	.....	Ohio Brass suspension, 9¾"		
	Suspension	Locke	9	Suspension	Locke	.....	.....	None	None	.....	.....	4 bolt suspension, 9"		
	Suspension	Locke	6	Suspension	Locke	.....	.....	None	None	.....	.....	4 bolt suspension, 9"		
	Pin	Victor	2	.....	Victor	.....	.....	None	None	.....	.....	Tie wire		
	Hewlett	Thomas	6	Hewlett	Thomas	At subs.	1	Thomas spoon	None	.....	.....	Link suspension, 8"		
	Hewlett suspension	Thomas	9	Hewlett suspension	Thomas	.....	.....	Thomas spoon	None	.....	.....	Thomas suspension, 8"		
	D	Ohio Brass	5	D	Ohio Brass	No	.....	None	None	.....	.....	.....		
	D	Ohio Brass	5	D	Ohio Brass	No	.....	None	None	.....	.....	Ohio Brass No. 11,552		
.....	Pin	Locke	5	10" disc	Locke	.....	.....	None	None	.....	.....	.....		
	10" disc.	Locke	5	10" disc	.....	No	.....	None	None	.....	.....	.....		
.....	Pin	Locke	5	10" disc	Locke	No	.....	None	None	.....	.....	.....		
	10" disc. B. & S.	Locke	9	10" disc B. & S.	.....	No	.....	Yes	.....	.....	.....	.....		
	10" disc.	Locke	5	10" disc	.....	No	.....	None	None	.....	.....	.....		
9	10" disc	Ohio Brass; Locke	9	10" disc	.....	Extra gr. wires	7	24" flat, 1st circuit	2nd circ.	15x30	15x30	.....		N
.....	Pin	Locke	5	10" disc	Locke	.....	.....	None	None	.....	.....	.....		
.....	Pin	Locke	5	10" disc	Locke	No	.....	None	None	.....	.....	.....		
.....	Pin	Locke	5	10" disc	Locke	.....	.....	None	None	.....	.....	.....		
.....	Pin	Locke	5	10" disc	Locke	No	.....	None	None	.....	.....	.....		
.....	Pin	Locke	5	10" disc	Locke	No	.....	None	None	.....	.....	.....		
.....	Pin	Locke	5	10" disc	Locke	No	.....	None	None	.....	.....	.....		
	10" disc	Locke	5	10" disc	.....	No	.....	None	None	.....	.....	.....		
8/9/10	10" disc	Ohio Brass	.....	.....	.....	Extra gr. wires	.....	.....	Yes	15x30	15x30	.....		
	10" disc	Locke	7	10" disc	.....	No	.....	Only in R. I. 15"	.....	.....	.....	.....		
/8/9	10" disc	W'hse; Locke	9; 9/8/9	10" disc	.....	Yes	7	24" flat 1st circuit	2nd circ.	15x30	15x30	.....		
	10" disc	Locke	7	10" disc	.....	.....	.....	None	None	.....	.....	.....		
	10" disc	Locke	7	10" disc	.....	No	.....	None	None	.....	.....	.....		
	10" disc	Ohio Brass	6	10" disc	.....	No	.....	None	None	.....	.....	.....		
.....	Pin	Locke	.....	.....	.....	No	.....	None	None	.....	.....	.....		
	10" disc	Locke	5	10" disc	.....	No	.....	None	None	.....	.....	.....		
	10" disc	Ohio Brass	9	10" disc	.....	No	.....	None	None	.....	.....	.....		
	10" disc	Ohio Brass	9	10" disc	.....	No	.....	None	None	.....	.....	.....		
	10" disc	Locke	5	10" disc	.....	No	.....	None	None	.....	.....	.....		
	10" disc	Ohio Brass	9	10" disc	.....	No	.....	None	None	.....	.....	.....		
	10" disc	Locke	5	10" disc	.....	No	.....	None	None	.....	.....	.....		
	10" disc	Ohio Brass	5	10" disc	.....	No	.....	None	None	.....	.....	.....		
	10" disc	Locke	5	10" disc	.....	No	.....	None	None	.....	.....	.....		
	10" disc	Locke	7	10" disc	.....	No	.....	None	None	.....	.....	.....		
	10" disc	Thomas	5	10" disc	.....	No	.....	None	None	.....	.....	.....		
	10" disc	Ohio Brass	6	10" disc	.....	No	.....	None	None	.....	.....	.....		
	10" disc	Thomas, Ohio B.	6	10" disc	.....	No	.....	None	None	.....	.....	.....		
	Suspension	Locke	10	Suspension	Locke	No	.....	Locke 30" spread	.....	Horns	30"	Locke No. 4,658 and No. 11,950		
	10" disc	Locke; Ohio Brass	6	10" disc	Locke, O. B.	No	.....	15"	None	.....	.....	2-bolt suspension, No. 2/0 wire		
.....	Pin	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....		
5	No. 1142	Thomas	6	No. 1,142	Thomas	No	.....	None	None	.....	.....	.....		
4	Hewlett	Thomas	5	Hewlett	Thomas	.....	.....	Own, Thomas, V. S.	.....	.....	.....	S. & P. No. 103, 6 bolt		
6	Hewlett	Thomas	7	Hewlett	Thomas	No	.....	Thomas, V. S.	.....	.....	.....	S. & P. No. 103, 6 bolt		
4	Hewlett	Thomas	5	Hewlett	Thomas	.....	.....	Own, Thomas, V. S.	None	.....	.....	S. & P., 6 bolt		
6	Metal cap No. 25,620	Ohio Brass	7	Metal cap	Ohio Brass	No	.....	None	.....	.....	.....	.....		
1	Pin	Thomas	1	.....	.....	No	.....	.....	.....	.....	.....	.....		
5	10" disc	Locke	6	10" disc	Locke	No	.....	Locke No. 5,029	None	.....	.....	Locke 5,147		
5	No. 8,400 b. s. suspension	Locke	9	No. 8,400 b. s. str.	Locke	No	.....	None	None	.....	.....	O. B. No. 72,366, No. 71,038, No. 71,042, No. 4/0		
5	Ball and socket	Ohio Brass	5	Ball and socket	Ohio Brass	No	.....	Ohio Brass	None	.....	.....	Ohio Brass No. 11,551, No. 4/0		
5	Jeffery-Dewitt	Jeffery-Dewitt	5	Jeffery-Dewitt	Jeffery-Dewitt	No	.....	Ohio Brass	None	.....	.....	Ohio Brass No. 11,551, No. 2/0		
5	Jeffery-Dewitt	Jeffery-Dewitt	5	Jeffery-Dewitt	Jeffery-Dewitt	No	.....	Ohio Brass	None	.....	.....	Ohio Brass No. 11,551, No. 4/0		
5	Jeffery-Dewitt	Jeffery-Dewitt	5	Jeffery-Dewitt	Jeffery-Dewitt	No	.....	Ohio Brass	None	.....	.....	Ohio Brass No. 11,551, No. 2/0		
5	Jeffery-Dewitt	Jeffery-Dewitt	5	Jeffery-Dewitt	Jeffery-Dewitt	No	.....	Ohio Brass	None	.....	.....	Ohio Brass No. 11,551, No. 2/0		
5	Jeffery-Dewitt	Jeffery-Dewitt	5	Jeffery-Dewitt	Jeffery-Dewitt	No	.....	Ohio Brass	None	.....	.....	Ohio Brass No. 11,551, No. 2/0		
5	Jeffery-Dewitt	Jeffery-Dewitt	5	Jeffery-Dewitt	Jeffery-Dewitt	No	.....	Ohio Brass	None	.....	.....	Ohio Brass No. 11,551, No. 4/0		
5	Ball and socket	Locke	5	Cap and pin	Locke	No	.....	None	None	.....	.....	Locke No. 15,075, No. 4/0		
6	Cap and pin	Westinghouse	6	Cap and pin	Westinghouse	No	.....	None	None	.....	.....	Westinghouse, No. 4/0		
5	Jeffery-Dewitt	Jeffery-Dewitt	5	Jeffery-Dewitt	Jeffery-Dewitt	No	.....	Ohio Brass	.....	.....	.....	Ohio Brass No. 11,551, No. 2/0		
5	Jeffery-Dewitt	Jeffery-Dewitt	5	Jeffery-Dewitt	Jeffery-Dewitt	No	.....	Ohio Brass	None	.....	.....	Ohio Brass No. 11,551, No. 2/0		
7	Hewlett	Thomas	7	Hewlett	Thomas	No	.....	Thomas V.S.	None	.....	.....	Thomas, No. 2/0		
1	Pin	Locke	1	Pin	Locke	No	.....	None	None	.....	.....	Tie wire, No. 4 Cu.		
.....	.....	.....	.....	.....	.....	No	.....	.....	.....	.....	.....	.....		
8	Suspension	Locke	9	Strain	Locke	No	.....	.....	.....	.....	.....	.....		
8	Suspension	Locke	9	Strain	Locke	No	.....	Lee clamps	.....	.....	.....	Locke No. 8,476; Ohio Brass No. 91,950		
8	Suspension	Locke	9	Strain	Locke	No	.....	.....	.....	.....	.....	.....		
10	Suspension	Locke	9	Strain	Locke	.....	.....	Locke No. 4,694	.....	.....	.....	Locke No. 3,032		
8	Suspension	Locke	9	Strain	Locke	No	.....	.....	.....	.....	.....	.....		
8	Suspension	Locke	9	Strain	Locke	6 susp., 7 strain	.....	Locke No. 4,694	.....	.....	.....	Locke No. 3,032		
8	Suspension	Locke	9	Strain	Locke	.....	.....	Lee clamps	None	.....	.....	Locke No. 8,476; Ohio Brass No. 119,506		
8	Suspension	Locke	9	Strain	Locke	.....	.....	Lee clamps	.....	.....	.....	Locke No. 8,476; Ohio Brass No. 119,506		
8	Suspension	Locke	9	Strain	Locke	.....	.....	Lee clamps	None	.....	.....	Locke No. 8,476; Ohio Brass No. 119,506		
1	Pin	.....	7	Strain	Locke	.....	.....	.....	.....	.....	.....	.....		
6	Suspension	Locke	7	Strain	Locke	.....	.....	.....	.....	.....	.....	.....		
1	Pin	.....	7	Strain	Locke	.....	.....	.....	.....	.....	.....	.....		
6	29 ml. pin; 7 ml. susp.	(Susp.) Locke	2, 7	Suspension	Locke	.....	.....	.....	.....	.....	.....	.....		
6	Suspension	Locke	7	Suspension	Locke	No	.....	.....	.....	.....	.....	.....		
5	Suspension	Hewlett	6	Strain	Hewlett	No	.....	.....	.....	.....	.....	.....		
6	Suspension	.....	7	Strain	.....	.....	.....	.....	.....	.....	.....	.....		
8	Suspension	Locke	9	Strain	Locke	.....	.....	Lee clamp	.....	.....	.....	Locke No. 5,200; Ohio Brass No. 11,950		
8	Suspension	Locke	9	Strain	Locke	No	.....	Lee clamp	.....	.....	.....	Locke No. 5,169; Ohio Brass No. 11,947		
8	Hewlett 10"	Thomas	10	Hewlett 10"	Thomas	No	.....	Thomas No. 5,482; No. 5,483	None	.....	.....	Thomas No. 10,009, No. 4/0		
4	Hewlett 10"	Thomas	5	Hewlett 10"	Thomas	No	.....	None	None	.....	.....	Ohio Brass strain clamps, No. 4/0		
7	No. 257	Jeffery-Dewitt	9	Ohio Brass No. 26,731	Ohio Brass	No	.....	None	None	.....	.....	.....		
7	Core and tine	Jeffery-Dewitt	9	Cap and pin	Lapp	No	.....	None	None	.....	.....	Malleable iron, to fit cable		2 pc
7	Core and tine	Jeffery-Dewitt	1x9	Core and tine	Jeffery-Dewitt	No	.....	None	None	.....	.....	Malleable iron, to fit cable		
7	Core and tine	Jeffery-Dewitt	2x9	Core and tine	Jeffery-Dewitt	No	.....	None	None	.....	.....	Malleable iron, to fit cable		
7	Core and tine	Jeffery-Dewitt	9	Cap and pin	Ohio Brass	No	.....	None	None	.....	.....	Malleable iron, to fit cable		Con
7	Core and tine	Jeffery-Dewitt	9	Cap and pin	Ohio Brass	No	.....	None	None	.....	.....	Malleable iron, to fit cable		
7	Cap and pin	Ohio Brass	9	Cap and pin	Ohio Brass	No	.....	None	None	.....	.....	Malleable iron, to fit cable		
7	Core and tine	Jeffery-Dewitt	2x8	Core and tine	Jeffery-Dewitt	No	.....	None	None	.....	.....	Malleable iron, to fit cable		2 pc
7	Core and tine	Jeffery-Dewitt	2x9	Core and tine	Jeffery-Dewitt	No	.....	None	None	.....	.....	Malleable iron, to fit cable		A
7	Hewlett	Thomas	7 or 8	Hewlett	Thomas	No	.....	Flat strap iron	None	.....	.....	Solid clamp, No. 4/0		
7	Hewlett	Thomas	7 or 8	Hewlett	Thomas	No	.....	Small round horn	None	.....	.....	Solid clamp, No. 4/0		
7	Hewlett	Thomas	7 or 8	Hewlett	Thomas	No	.....	Small round horn	None	.....	.....	Solid clamp, No. 4/0		
7	Hewlett	Thomas	7 or 8	Hewlett	Thomas	No	.....	Small round horn	None	.....	.....	Solid clamp, No. 4/0		
7	Hewlett	Thomas	7 or 8	Hewlett	Thomas	No	.....	Thomas V. S.	None	.....	.....	Solid clamp, No. 4/0		A
7	Hewlett	Thomas	7 or 8	Hewlett	Thomas	No	.....	Small round horn	None	.....	.....	Solid clamp, No. 4/0		
7	Hewlett	Thomas	7 or 8	Hewlett	Thomas	No	.....	Small round horn	None	.....	.....	Solid clamp, No. 4/0		
7	Hewlett	Thomas	7 or 8	Hewlett	Thomas	No	.....	Small round horn	None	.....	.....	Solid clamp, No. 4/0		
7	Hewlett	Thomas	7 or 8	Hewlett	Thomas	No	.....	Small round horn	None	.....	.....	Solid clamp, No. 4/0		
7	Hewlett	Thomas	7 or 8	Hewlett	Thomas	No	.....	Small round horn	None	.....	.....	Solid clamp, No. 4/0		
7	Hewlett	Thomas	7 or 8	Hewlett	Thomas	No	.....	Thomas V. S.	None	.....	.....	Solid clamp, No. 4/0		
8	Cap and pin No. 8,400	Locke	9	Cap and pin No. 8,400	Locke	No	.....	Top only, No. 12,151	Bot. only	.....	.....	Locke 12,151; Ohio Brass susp. and strain, No. 4/0		
5	Cap and pin	Locke	6	Cap and pin	Locke	No	.....	.....	None	.....	.....	Ohio Brass suspension and strain, No. 1/0		
8	Cap and pin	Locke	9	Cap and pin	Locke	No	.....	Old standard	None	.....	.....	Ohio Brass suspension and strain, No. 4/0		
8	Jeffery-Dewitt No. A-257	Jeffery-Dewitt	9	Jeffery-Dewitt No. A-257	Jeffery-Dewitt	5 susp. & 8 str.	for 5 twrs)	No	None	.....	.....	Ohio Brass suspension and strain, No. 4/0		
5	Jeffery-Dewitt No. A-257	Jeffery-Dewitt	6	Jeffery-Dewitt No. A-257	Jeffery-Dewitt	No	.....	None	1 circ.	.....	.....	Ohio Brass suspension and strain, No. 1/0		
8	Hewlett link No. 11,029	Thomas	2x9	Hewlett link No. 11,029	Thomas	No	.....	Old standard	None	.....	.....	Ohio Brass susp. No. 71,038, str. No. 72,366, No. 4/0		
5	Jeffery-Dewitt	Jeffery-Dewitt	5	Jeffery-Dewitt	Jeffery-Dewitt	No	.....	No	None	.....	.....	Ohio Brass suspension and strain, No. 1/0		
4	Jeffery-Dewitt No. A-257	Jeffery-Dewitt	4	Jeffery-Dewitt No. A-257	Jeffery-Dewitt	No	.....	No	.....	.....	.....	Ohio Brass suspension and strain, No. 1/0		
8	Suspension disc	Locke No. 5,800	9	Suspension disc	Locke No. 5,800	No	.....	Ohio Brass No. 11,950	None	.....	.....	Suspension, Locke No. 5,200		

ve 66,000 Volts

Conductor and Insulator Protection							Communication System Used	No. of Line
	Arresters		Overhead Ground Wire			Type of Ground Used on Poles or Towers		
Splicing Method (37)	Type (38)	Manufacturer (39)	Material (40)	Size Inches (41)	No. Used (42)	(43)	(44)	(1)
Aluminum Co. twist joints	L. V.	W'hse	.....	.....	.....	Wrapped pole butt	None	1
Compression joint	Oxide film	G. E.	None	.....	.....	Wrapped pole butt	None	2
Parallel sleeve	Oxide film	G. E.	None	.....	.....	Wrapped pole butt	None	3
Parallel sleeve	Oxide film	G. E.	Steel	¼	1	Tower galvanized and in earth	None	4
Aluminum Co. twist joint	Oxide film	G. E.	Crucible steel	5/16	1	Wrapped pole butt	None	5
Aluminum Co. twist joint	Oxide film	G. E.	S.-M. galvanized steel	7/16	2	Wrapped pole butt	None	6
Sleeves	Aluminum cell at Bennington	G. E.	None	.....	.....	Butt wrapped with 3/8" guy	None	7
Sleeves	None	.....	None	.....	.....	None	None	8
Twist sleeve	Yes	.....	Cu.	No. 2	1	Charcoal cone	Telephone	9
Twist sleeve	Yes	.....	None	.....	.....	3/8" steel strand	Telephone	10
Twist sleeve	Yes	.....	None	.....	.....	3/8" steel strand	Telephone	11
Twist sleeve	Yes	.....	Galvanized steel	7/16	2	None	Telephone	12
Twist sleeve	Yes	.....	None	.....	.....	3/8" steel strand	Telephone	13
No. 1, twist sleeve; No. 2 compr.	Yes	.....	Galvanized steel	7/16	2 per circ.	None	Telephone	14
Twist sleeve	Yes	.....	None	.....	.....	3/8" steel strand	Telephone	15
Twist sleeve	Yes	.....	Cu.	No. 2	1	Charcoal cone	Telephone	16
Twist sleeve	Yes	.....	Cu.—clad	No. 6	1	3/8" steel strand	Telephone	17
Twist sleeve	Yes	.....	None	.....	.....	3/8" steel strand	None	18
Twist sleeve	Yes	.....	Cu.	No. 2	1	Charcoal cone	Telephone	19
Twist sleeve	Yes	.....	Cu.—clad	½	1	None	Telephone	20
Twist sleeve	Yes	.....	None	.....	.....	3/8" steel strand	Telephone	21
Twist sleeve	Yes	.....	Galvanized steel	7/16	2	None	Telephone	22
Twist sleeve	Yes	.....	Galvanized steel	5/16	1	None	Telephone	23
Twist sleeve	Yes	.....	Galvanized steel	5/16, 7/16	2 per line	None	None	24
Twist sleeve	Yes	.....	Galvanized steel	5/16	1	None	Telephone	25
Twist sleeve	Yes	.....	Galvanized steel	5/16	1	None	Telephone	26
Twist sleeve	Yes	.....	Galvanized steel	5/16	1	3/8" steel strand	Telephone	27
Twist sleeve	Yes	.....	Cu.-clad	½	1	None	Telephone	28
Twist sleeve	Yes	.....	None	.....	.....	3/8" steel strand	None	29
Twist sleeve	Yes	.....	None	.....	.....	3/8" steel strand	None	30
Twist sleeve	Yes	.....	None	.....	.....	3/8" steel strand	None	31
Twist sleeve	Yes	.....	Galvanized steel	7/16	1	None	Telephone	32
Twist sleeve	Yes	.....	None	.....	.....	3/8" steel strand	None	33
Twist sleeve	Yes	.....	Galvanized steel	7/16	1	None	None	34
Twist sleeve	.....	.....	None	.....	.....	3/8" steel strand	None	35
Twist sleeve	.....	.....	None	.....	.....	3/8" steel strand	Telephone	36
Twist sleeve	.....	.....	Galvanized steel	5/16	1	None	Telephone	37
Twist sleeve	.....	.....	None	.....	.....	3/8" steel strand	None	38
Twist sleeve	.....	.....	None	.....	.....	3/8" steel strand	None	39
Twist sleeve	.....	.....	Galvanized steel	5/16	1	None	None	40
19½" Cu. sleeves	None	.....	S.-M. stranded steel	7/16 dia.	1	Copperweld ground rods	Bell	41
Sleeve	At terminals, oxide film	G. E.	Stranded steel	3/8	1	Coil of str. Cu. wire buried	Private telephone line leased	42
.....	Electro	.....	Cu.-clad	No. 6	.....	.....	2-wire metallic	43
Sleeve	At terminals, Aluminum	G. E.	7-str. galvanized steel	3/8, 7 str.	1	Driven ground	None	44
Cu. sleeve	Aluminum cell	G. E.	Galvanized steel	3/8	1	Coil Cu. wire	Telephone and carrier	45
Cu. sleeve	Aluminum cell	G. E.	Galvanized steel	5/16	1	Coil Cu. wire	Carrier	46
Cu. splice sleeve	Aluminum cell	G. E.	Galvanized steel	5/16	1	Coil Cu. wire	Telephone and carrier	47
.....	Aluminum cell	.....	Galvanized steel	7/16	1	Coil Cu. wire	Carrier	48
.....	Aluminum cell	G. E.	Galvanized steel	3/8	1	Coil Cu. wire	Telephone	49
Sleeve	None	.....	S.-M. galvanized steel	5/16	.....	Ground rod	Bell telephone	50
/0	None	.....	D'ble galv., high s. st'd	5/16	1	No. 1/0 Cu. coil under concrete (1)	Carrier	51
Sleeves	Bennett	El. Pr. Eq.	Copperweld	1/4	1	Ground plate	Commercial	52
Sleeves	Oxide film	G. E.	Steel	5/16	2	Ground plate	Commercial	53
Sleeves	Oxide film	G. E.	Copperweld	1/4	1	Earth anchor	Commercial	54
Sleeves	Oxide film	G. E.	Copperweld	1/4	1	Earth anchor	Commercial	55
Sleeves	Oxide film	G. E.	Copperweld	1/4	2	Ground plate	Private cable on towers	56
Sleeves	Auto-valve	W'hse	Copperweld	1/4	1	Earth anchor	Commercial	57
Sleeves	Auto-valve	W'hse	Copperweld	1/4	1	Earth anchor	Commercial	58
Sleeves	Auto-valve	W'hse	Copperweld	1/4	2	Earth anchor	Commercial	59
Sleeves	Auto-valve	W'hse	None	.....	.....	None	Same poles as line	60
Sleeves	Oxide film	G. E.	Copperweld	No. 0	1	Earth anchor	Commercial	61
Sleeves	Oxide film	G. E.	Copperweld	1/4	1	Earth anchor	Commercial	62
Sleeves	Oxide film	G. E.	Copperweld	1/4	1	Ground plate	Commercial	63
Sleeves	Auto-valve	W'hse	None	.....	.....	Ground plate	Commercial	64
Sleeves	Electrolytic	W'hse	Galv. steel stranded	5/16	1	Ground rod	Telephone	65
Sleeves	At sub., oxide film	G. E.	.....	.....	.....	Pole ground with 3/8" galv. steel	None	1
Sleeves	At sub., oxide film	G. E.	Copperweld	5/16, 7 str.	2	Earth footing	None	2
.....	At sub., oxide film	G. E.	Copperweld	5/16, 7 str.	1	.....	Telephone on separate poles	3
Sleeves	At sub., oxide film	G. E.	Copperweld	5/16, 7 str.	1	Earth footing	None	4
.....	At sub., oxide film	G. E.	Siemens-Martin 7 str.	3/8	1	.....	Telephones on towers	5
Sleeves	At sub., oxide film	G. E.	Copperweld 7 str.	3/8	1	Earth footing	None	6
Sleeves	At sub., oxide film	G. E.	Copperweld	5/16, 7 str.	2	Earth footing	None	7
Sleeves	At sub., oxide film	G. E.	Copperweld	5/16, 7 str.	2	Earth footing	Separate pole line telephone	8
Sleeves	At sub., oxide film	G. E.	Copperweld	5/16, 7 str.	2	Earth footing	None	9
.....	At sub., oxide film	G. E.	.....	.....	None	.....	Telephone on same poles	10
.....	At sub., oxide film	G. E.	Copperweld	3/8	1	Pole gr. with No. 4 W. P. Cu.	Telephone on trans. poles	11
.....	At sub., oxide film	G. E.	.....	.....	None	.....	Telephone on same poles	12
.....	At sub., oxide film	G. E.	C. S.; S.-M. 7 str.	7/16; 3/8	1	.....	Telephone on towers	13
.....	At sub., oxide film	G. E.	Siemens-Martin 7 str.	3/8	1	.....	Telephone on towers	14
.....	At sub., oxide film	G. E.	C. S. stranded	7/16	1	.....	Telephone circuit on tower	15
.....	At sub., oxide film	G. E.	Siemens-Martin 7 str.	3/8	1	.....	None	16
Sleeves	At sub., oxide film	G. E.	.....	.....	.....	Pole gr. with 3/8" 7 str. galv. steel	Telephones on separate poles	17
Sleeves	At sub., oxide film	G. E.	Copperweld	5/16, 7 str.	2	Earth footing	Separate pole line	18
Cu. sleeves	None	.....	S.-M. stranded steel	7/16	1	Driven	Carrier current	19
Cu. sleeves	Oxide film	G. E.	.....	.....	.....	None	Telephone	20
McIntyre sleeves	None	.....	Siemens-Martin steel.	3/8	2	.....	.....	21
2 pc. Aluminum compression joint	None	.....	High str. cruc. st. galv.	5/16	2	Tower footings	Private wire telephone; carrier	22
Cu. twist sleeves	None	.....	High str. cruc. st. galv.	5/16	2	Tower footings	None	23
Cu. twist sleeves	None	.....	High str. cruc. st. galv.	5/16	2	Tower footings	Private wire and Bell telephone	24
Compr. joints A.C.S.R. twist sleeves	None	.....	High str. cruc. st. galv.	5/16	2	Tower footings	Bell telephone	25
Twist sleeves	None	.....	High str. cruc. st. galv.	5/16	2	Tower footings	Bell telephone	26
Twist sleeves	None	.....	None	.....	None	.....	Private wire telephone and carrier	27
2 pc. Aluminum compression joint	None	.....	High str. cruc. st. galv.	5/16	2	Tower footings	Carrier and Bell telephone	28
Aluminum compression joints	None	.....	High str. cruc. st. galv.	5/16	2	Tower footings	Carrier and Bell telephone	29
Cu. sleeves	Oxide film	G. E.	Siemens-Martin galv.	5/16	1	None	General Electric carrier, wireless	30
Cu. sleeves	None	.....	Siemens-Martin galv.	5/16	1	None	General Electric carrier, wireless	31
Cu. sleeves	None	.....	Siemens-Martin galv.	5/16	1	None	General Electric carrier, wireless	32
Cu. sleeves	None	.....	Siemens-Martin galv.	5/16	1	None	General Electric carrier, wireless	33
Aluminum compression sleeves	None	.....	Siemens-Martin galv.	5/16	1	None	None	34
Cu. sleeves	None	.....	Siemens-Martin galv.	5/16	1	None	General Electric carrier, wireless	35
Cu. sleeves	None	.....	Siemens-Martin galv.	5/16	1	None	General Electric carrier, wireless	36
Cu. sleeves	None	.....	Siemens-Martin galv.	5/16	1	None	General Electric carrier, wireless	37
Cu. sleeves	None	.....	Siemens-Martin galv.	5/16	1	None	General Electric carrier, wireless	38
Cu. sleeves	None	.....	Siemens-Martin galv.	5/16	1	None	General Electric carrier, wireless	39
Cu. sleeves	None	.....	Siemens-Martin galv.	5/16	1	None	None	40
/0 Twist sleeves	Oxide film	G. E.	5-mi. Cu.-weld, bal.h.s.	5/16	1	None	Carrier	41
/0 Twist sleeves	Oxide film	G. E.	Copper-clad steel	7/16		None	Private line	42
Twist sleeves	Oxide film	G. E.	Copper-clad steel	5/16	1	None	Leased line	43
Twist sleeves	Oxide film	G. E.	Str. high strength galv.	5/16	1	None	Private, separate poles	44
Twist sleeves	Oxide film	G. E.	S.-M. galv. steel	5/16	1	None	Private, separate poles	45
/0 Twist sleeves	Oxide film	G. E.	No ground wire	.....	.....	None	Leased wire	46
Twist sleeves	Oxide film	G. E.	Galv. S.-M. stranded	5/16	1	Copperweld rod every pole	Leased line	47
Twist sleeves	Oxide film	G. E.	None	.....	.....	None	Private line	48
Seamless Cu. sleeves	Aluminum cell	G. E.	None	.....	.....	3/8" galvanized guy strand	Private telephone	49

36	Taylorville—Brown Falls	1923	100,000	110	60	Steel towers	2	28.11		
37	Taylorville—Soft Maple	1925	100,000	110	60	Steel towers	2	4.51		
38	Black River—Altmar	1925	100,000	110	60	Steel towers	2	55.66		
39	Black River—Taylorville	1926	100,000	110	60	Steel towers	2	25.87		
40	Norwood—Norfolk—Raymondville	1927	50,000	88	60	Steel towers	1	4.31		
	Central Hudson Gas & Electric Corp.									
41	Poughkeepsie—Falls Village, Conn.	1927	15,000	110(7)	60	Steel towers	1 (ult. 2)	37 (8)		
42	Poughkeepsie—Athens	1918	60,000	66	60	Steel towers	2	46.45		
43	Catskill—Rotterdam	1922	22,000	110(7)	60	Steel towers	2	45		
44	Ohioville—East Walden	1924	20,000	66	60	Steel towers	2	13		
45	East Walden—West Balnville	1925	25,000	66	60	Steel towers	2	8.6		
46	East Walden & West Wharton, N. J.	1926	30,000	110	60	Steel towers	2	58		
47	West Balnville—Highland	1928	15,000	66	60	Wood poles	1 (ult. 2)	13.4		
48	Sturgeon Pool—High Falls	1924	5,000	66(10)	60	Wood poles	1	5.7		
	New York State Gas & Electric Corp.									
49	Otsego—Herkimer County line—Collierville	1924	73,000	110	60	50 ft. wood poles	1	29.6		
	St. Lawrence County Utilities Inc.									
50	Allens Falls—Hannawa Falls	1927	15,000	88	60	Steel towers	1	11		
51	Hannawa—Pyrites	1913	40,000	88	60	Steel towers	2	12.5		
52	Pyrites—Ogdenburg	1919	20,000	88	60	Wood poles	1	23		
53	Pyrites—Gouverneur	1925—1927	20,000	88	60	Steel towers	1	21		
54	Higley Falls—Massena	1913—1918	60,000	110	60	Steel towers	2	31		
	Public Service Electric & Gas Co.									
55	Trenton—Biles Island (Phila. Electric Co.)	1926	50,000	66	60	Steel towers	2	4.5		
56	Essex—Kearny—Marion	1926	125,000	132	60	Steel towers	2	2.7		
57	Kearny—Athenia	1927	125,000	132	60	Steel towers	2	11.9		
58	Athenia—Roseland	1928	125,000	132	60	Steel towers	2	11		
59	Roseland—West Orange	1928	125,000	132	60	Steel towers	2	4.5		
60	Roseland—Metuchen	1929	125,000	132	60	Steel towers	2	23		
61	Metuchen—Trenton	(Fall, 1929)	125,000	132	60	Steel towers	3/4s; 3/4as kv.	28.5		
62	Roseland—Bushkill (Pa. Power & Light Co.)	(Fall, 1929)	200,000	220	60	Steel towers	1	44.5		
	New Jersey Power & Light Co.									
63	Easton, Pa.—West Wharton, N. J.	1925	70,000	110	60	Steel towers	2	54		
64	West Wharton, N. J.—East Walden, N. Y.	1926	55,000	110	60	Steel towers	2	56.25		
	Luzerne County Gas & Electric Corp.									
65	Plymouth Plant—Wilkes Barre Sub. (Pa. Power & Light)	1925	40,800	66	60	Steel towers	1	4.0		
66	Plymouth Plant—Swoyersville Sub	1924	30,000	66	60	Both	2	6.8		
67	Swoyersville Sub.—Stanton Plant (Pa. Power & Light)	1928	45,000	66	60	Wood poles	1	3.93		
68	Hunlock Plant—Berwick Sub. (Pa. Power & Light)	1928	40,000	66	60	Wood poles	1	7.94		
69	Hunlock Plant—Wanamie Sub	1926	45,000	66	60	Steel towers	1	2.7		
70	Hunlock Plant—Plymouth Plant	1925	40,000	66	60	Steel towers	2	9.6		
71	Plymouth Plant—Wanamie Sub	1925	30,000	66	60	Wood poles	1	9.1		
	Metropolitan Edison Co.									
72	Spring Grove—Hanover	1927	.....	66	60	Wood poles	1	8.77		
73	York—Spring Grove	1927	.....	66	60	Wood poles	1	12.35		
74	York—Hanover	1924	.....	66	60	Wood poles	1	18.9		
75	Middletown—York	1924	59,000	66	60	Steel towers	2	17.7		
76	Lebanon—Middletown	1922	44,000	66	60	Wood poles	2	25		
77	Reading—Lebanon	1922	38,000	66	60	Wood poles	2	28.8		
78	Reading—Middletown	1924	25,000	110	60	Wood poles	1	60.1		
79	Reading—Easton	1923	80,000	110	60	Steel towers	2	47.5		
	The Philadelphia Electric Co.									
80	Flat Rock Tunnel—Westmoreland	1928	100,000 per circ.	66	60	Steel towers	2 (ult. 4)	4.7		
81	Plymouth Meeting—Flat Rock Tunnel	.....	100,000 per circ.	66	60	Steel towers	2	5.38		
82	Plymouth Meeting—Towamencin Two	1928	125,000	220	60	Steel towers	1	9.856		
83	Plymouth Meeting—Trenton Cutoff of P. R. R.	1928	50,000; 125,000	66(11)	60	Steel towers	2 (ult. 3)	2.45		
84	Conowingo—Plymouth Meeting	1928	125,000	220	60	Steel towers	1 (two lines)	57.73		
85	Philadelphia—Biles Island	1926	40,000	66(12)	60	Steel towers	2	24.58		
86	Philadelphia—Chester—Marcus Hook	'17 Phila.-Chester, '22 Chester-M.H.	40,000 per circ.	66	60	Steel towers	2	15.8		
87	Marcus Hook—Del. State Line	1926	.....	66(12)	60	Steel towers	2	2.9		
	American Power Co.									
88	Wilmington—Chester, Pa.	1926—1927	100,000	66	60	Steel towers	2	9.8		
	Penn Central Light & Power Co.									
89	Roxbury and K. R. P. 3 Switch	1925	10,000	66	60	Wood poles	1	6.03		
	Pennsylvania Electric Co.									
90	Hooversville—Deep Creek	1926	8,000	110	60	Wood poles	1	53.4		
91	Seward—Hooversville	1922	16,000	110	60	Steel towers	2	18.6		
92	Seward—Blairsville	1924	10,000	66	60	Wood poles	1	12.8		
93	Seward—Glory	1921	10,000	66	60	Steel towers	2	18.3		
94	Piney—Glory	1923	12,000	110	60	Steel towers	2	48.7		
95	Glory—Philipsburg	1928	9,000	110	60	Wood poles	1	42.16		
96	Piney—Erie	1926	10,000	110	60	Wood poles	1	71.6		
97	Piney—Warren, Penna. Electric Co. Section	1926	18,000	132	60	Wood poles	1	58		
98	Warren—Falconer, Penna. Elec. Co. Section	1926	15,000	110	60	Wood poles	1	12		
	Duquesne Light Co.									
99	Colfax Power Station—Hiland Sub	1928	60,000	66	60	Steel towers	1	9.27		
100	Brunot Island Power Station—Colfax Power Station	1916—1921—1925	45,000	66	60	Steel towers	2	108		
	West Penn Power Co.									
101	Windsor—Washington	1917	88,000	132	60	Steel towers	2	26.12		
102	Washington—Charleroi	1923	88,000	132	60	Steel towers	2	16.98		
103	Charleroi—Lake Lynn	1925	88,000	132	60	Steel towers	2	29.57		
104	Springdale—Charleroi	1925	88,000	132	60	Steel towers	2	31.36		
105	Springdale—Kittanning	1920	88,000	132	60	Steel towers	2	23.60		
106	Kittanning—Piney Dam	1926	30,000	132	60	W. P. (.8 mi. S. T.	1	29.04		
107	Springdale—Butler	1926	88,000	132	60	Steel towers	2	22.89		
108	Springdale—Colfax	1925	72,000	132	60	Steel towers	1	2.70		
109	Springdale—Luzor	1920	88,000	132	60	Steel towers	2	21.10		
110	Ridgway Sub. Station—Spring Creek Tower-Line	1926	30,000	132	60	Wood poles	1	4.40		
111	Ridgway Sub. Station—McKean	1927	30,000	132	60	Wood poles	1	17.30		
	EAST NORTH CENTRAL									
	Dayton Power & Light Co.									
1	Dayton-Cincinnati (Hartwell). East Line Section Dayton Outskirts to Carlisle Junction	1923	12,500	66	60	Wood poles	1	10.4		
2	(1) Dayton-Cinn. (Hartwell). East and West Circuits Section of Line in Dayton to Outskirts of City	1923	25,000	66	60	Steel towers	2	3.5		
3	(2) Dayton-Cincinnati (Hartwell). West Line Section Dayton Outskirts to Carlisle Junction	1923	12,500	66	60	Wood poles	1	12.3		
	Ohio Public Service Co.									
4	Alliance—Canton	1923	50,000	132	60	Steel towers	1	20.0		
5	Ashland—Lorain	1924	50,000	132	60	Steel towers	1	45.6		
6	Ashland—Mansfield	1923	40,000	66	60	Steel towers	1	13.8		
7	Canton—Massillon	1928	50,000	132	60	Steel towers	1	12.2		
8	Lorain—Sandusky	1926	50,000	132	60	Steel towers	1	36.1		
9	Massillon—Ashland	1928	50,000	132	60	Steel towers	1	41.9		
9a	Melco Plant—Longview Sub. Station (Melco 66,002 Line)	1916	15,000	66(4)	60	Wood poles	1	14.0		
10	Sandusky—Toledo (Al. from Sandusky to Northside of Sandusky Bay, 8.1 miles)	1928	50,000	132	60	Steel towers	1	46.7 (5)		
11	Warren—Alliance	1923	50,000	132	60	Steel towers	1	25.0		
12	Warren—P. O. System	1924	50,000	132	60	Steel towers	1	5.0		
	Ohio Utilities Co.									
13	Chillicothe—Seaman	1927—1928	66,000	66	60	Wood poles	1	40.0		
	Pennsylvania-Ohio Power & Light Co.									
14	Boardman—Canfield (Y36)	1926	.....	66	60	Wood poles	1	6.6		
15	Canfield—Salem (Y37)	1926	.....	66	60	Wood poles	1	13.2		
16	Masury—Sharon (Y81)	1925	.....	66	60	Steel towers	2	3.8		
17	Poland—Struther (Y87)	1926	.....	66	60	Steel towers	2	2.4		
18	Salt Springs—Boardman (Z75)	1928	.....	132	60	Steel towers	1	9.3		
19	Sharon—Greenville (Y83)	1926	.....	66(6)	60	Steel towers	1	14.4		
20	Toronto—Boardman (Z-73)	1925	.....	132	60	Steel towers	2	40.0		
21	Toronto—Boardman (Z-74)	1925	.....	132	60	Steel towers	2	40.0		
22	Toronto—Lowellville (Z-72)	1928	.....	132	60	Steel towers	2 (7)	46.8		
23	Toronto—New Castle (Z-71)	1928	.....	132	60	Steel towers	2 (7)	49.7		
	Southern Ohio Electric Co.									
24	Pomeroy—Superior—Circleville	1922 to 1926	66,000	66	60	Wood poles	1	156.0		
	Toledo Edison Co.									
25	Acme Station—Fitch	1922	50,000	66	60	Steel towers	2	11.0		
26	Acme Station—Walbridge	1924	50,000	69	60	Steel towers	4	5.0		
27	Fitch—Walbridge	1924	50,000	69	60	Steel towers	2	15.0		
28	Toledo, Ohio—Michigan State line	1927	50,000	69	60	Steel towers	1	10.0		
29	Toledo—point 15 miles east of Toledo	1928	100,000	132	60	Steel towers	1	15.0		
30	Walbridge—Pemberville	1923	50,000	69	60	Wood poles	1	13.0		
	Union Gas & Electric Co.									
31	Cincinnati (Hartwell)—Dayton	1923	12,500	66	60	Wood poles	1	13.4		
32	Cincinnati (Hartwell)—Dayton. East line Hartwell—Carlisle except section shown for line 31	1923	12,500	66	60	Wood poles	1	38		
33	Cincinnati (Hartwell) Dayton. West line section Hartwell—Hamilton—Trenton—Carlisle Junction	.....	12,500	66	60	Wood poles	1	40		
34	Columbia—Hartwell	1925	60,000	66	60	Steel towers	2	20		
35	Columbia—Hartwell	1925	60,000	66	60	Steel towers	2	20		
36	Columbia Power Station to Indiana State Line	1927	30,000, 100,000	132	60	Steel towers	2	0.7		
37	Hamilton Contreas (9)	1924	7,500	66	60	Wood poles	1	21		
38	Hartwell—Elmwood	1923	25,000	66	60	Wood poles	1	2.5		
39	Hartwell—Elmwood	1923	25,000	66	60	Wood poles	1	2.5		
40	Hartwell—Mitchell Avenue	1925	60,000	66	60	Steel towers	2	3.8		
41	Oakley—Hartwell	1925	60,000	66	60	Steel towers	2	6		
42	Trenton—Middletown	1928	24,000	66	60	Steel towers	2	3.4		
	Indiana Electric Corp.									
43	Dresser (Terre Haute)—Clinton "A" Route	1925	6,000	66	60	Both (10)	1	21.2		
44	Dresser (Terre Haute)—Clinton "B" Route	1927	6,000	66	60	Wood poles	1	24.36		
45	Dresser (Terre Haute)—Sullivan	1925	6,000	66	60	Wood poles	1	24.73		
46	Dresser—Water Street Plants (Terre Haute)	1925	6,000	66	60	Both	2	7.34		
47	Kokomo—Howard—Brant County line connection to Indiana General Service Co.	1928	30,000	132	60	Steel towers	2	17 to Co. line		
48	Lenore (Indianapolis)—Columbia (Cincinnati) (11)	1928	30,000	132	60	Steel towers	2	6.1		
49	Lenore (Indianapolis)—Columbia (Cincinnati) (12)	1928	30;000	132	60	Steel towers	2 (13), 1	76.74		
50	Lenore (Indianapolis)—Dresser (Terre Haute)	1924	30,000	132	60	Steel towers	2	73.86		
51	Lenore (Indianapolis)—Knightstown	1924	6,000	66	60	Wood poles	1	41.31		
52	Lenore (Indianapolis)—Shelbyville (14)	1928	6,000	66	60	(14)	(14)	26.4		
	Interstate Public Service Co.									
53	Bedford—Edwardsport	1925	15,000	66	60	Steel towers	2	42.4		
54	Connersville—New Castle	1926	6,000	66	60	Wood poles	1	28.2		
55	Connersville—Ohio State Line	1924	6,000	66	60	Wood poles	1	20.4		
56	Jeffersonville—Scottsburg	1925	5,000	66	60	Steel towers	1	29.7		
57	Knightstown—New Castle	1925	10,000	66	60	Wood poles	1	14.9		
58	New Castle—Henry County Line	1928	.....	66	60	Wood poles	1	15.8		
59	Scottsburg—Bedford	1924	5,000	66	60	Wood poles	1	42.6		
	Northern Indiana Power Co.									
60	Converse—Indiana General Service Connection	1928	4,000	66	60	Wood poles	1	5.6		
61	Kokomo—La Fayette	1925	6,000	66	60	Wood poles	1	42.7		
62	Kokomo—Wabash	1928	6,000	66	60	Wood poles	1	36.63		
63	Lenore (Indianapolis)—Noblesville	1925	6,000	66	60	Wood poles	1	34.08		
64	Noblesville—Kokomo	1925	6,000	66	60	Wood poles	1	39.26		
65	Noblesville to Madison—Henry County Line	1928	6,000	66	60	Wood poles	1	30.8		
	Northern Indiana Public Service Co.									
66	Aetna—Michigan City	1926	50,000	132	60	Steel towers	1 (15)	23.0		
67	Indiana—Illinois State Line to Aetna	1924 and 1925	50,000	132	60	Steel towers	1 (15)	13.8		
68	Michigan City—New Carlisle	1926	50,000	132	60	Steel towers	1 (15)	22.75		
	Wabash Valley Electric Co.									
69	Attica Loop	1925	6,000	66	60	Wood poles	2	6.11		
70	Attica Loop Junction—La Fayette	1925	6,000	66	60	Wood poles	1	18.89		
71	Clinton—Covington Double Circuit Junction	1925	6,000	66	60	Wood poles	1	35.94		
72	Covington—Attica Loop Junction	1925	6,000	66	60	Wood poles	1	27.60		
73	Covington Double Circuit Junction—State Line	1927	6,000	66	60	Wood poles	1	6.45		
74	Double Circuit Junction—Covington	1923 and 1927 (16)	6,000	66	60	Wood poles	2	2.93		
	Central Illinois Public Service Co.									
75	Grand Tower—Mound City	1928	10,000	66	60	Wood poles	1	57.01		
76	Muddy—Effingham	1926	10,000	66	60	Wood poles	1	122.92		
77	Muddy—Shawneetown	1924	20,000	66	60	Steel towers	2	27.18		
78	Muddy—West Frankfort	1922	20,000	66	60	Steel towers	2	24.75		
79	West Frankfort—Grand Tower	1923	50,000	66	60	Steel towers	2	35.69		
	Commonwealth Edison Co.									
80	Calumet Station—108th St., Chicago—Chicago Heights—108th St., Chicago, Ill.—Aetna, Ind. (17)	1925	.....	132	60	Steel towers	2	3.8		
	East St. Louis Light & Power Co.									
81	Cahokia—Canterville—(Belleville)	1927	30,000	66	60	Steel towers	2	5		
82	Cahokia—Venice	1927	50,000	66	60	Steel towers	2	4.8		
83	Lake Avenue Substation—Alton	1915	12,000	66	25	Steel towers	1	24		
84	Venice—Alton	1927	24,000	66	60	Steel towers	2	16.56		

25	54	660	21	1,350	Vertical	110,000	6 or 7	Hewlett	Thomas	7 or 8	Hewlett	Thor
26	54	660	21	1,350	Vertical	110,000	6 or 7	Hewlett	Thomas	7 or 8	Hewlett	Thor

4,014; 8,210	8	Channel and strain	Archbold-Brady	Cu.	211,600	120	25	34	660
4,014; 8,210	8.5	Channel and strain	Archbold-Brady	Cu.	211,600	120	25	34	660
4,014; 8,210	9	Channel and strain	Archbold-Brady	Cu.	211,600	120	25	34	660
4,014; 8,210	9	Channel and strain	Archbold-Brady	Cu.	211,600	120	25	34	660
4,014; 8,210	14	Channel and strain	Archbold-Brady	Cu.	211,600	120	25	34	660
6,925; 12,050 (9); 13,753–21,669	11.5, 16.5	Square base	B.-K., Lehigh	5 mi. Cu.; 17.4 mi. A.C.S.R.	Cu. No. 4-0; A.C.S.R. 4-0	120	Pole 18; t'r 25	42	300; 500; 650
3,800	10	Square base	Riter-Conley	7 strand h.d. Cu.	105,500	90	25	30	500
7,200 (9); 11,175	8	Square base	Archbold-Brady	7 strand h.d. Cu.	211,600	114	25	42	660
6,680; 9,000	8.33	Square base	Riter-Conley	7 strand h.d. Cu.	211,600	114	25	42	660
4,655; 5,765	10.4	Square base	Riter-Conley	7 strand Cu.	105,500	90	25	30	500
6,230; 6,855; 8,000	7.65	Square base	R.-C.; Lehigh	A.C.S.R.	No. 0000	120	25	42	700
	22			7 strand Cu.	105,500	72	20	30	250
	20			7 strand h.d. Cu.	105,500	100	22	30	260
	13	H-structure	Western Red Cedar	7 strand h.d. Cu.	211,600	150	20	34	400
	18		Riter-Conley	A.C.S.R.	No. 0	100	25		300
	10		Milliken	A.C.S.R.	No. 000	120	25		550
	11		Milliken	A.C.S.R.	No. 000	120	21		500
	11		Riter-Conley	A.C.S.R.	No. 000	120	25		500
	10		Milliken, Blaw-Knox	A.C.S.R.	No. 000	120	25		550
11,000	7	Double circuit	Archbold-Brady	A.C.S.R.	477,000 (40%)	156	40	42	800
32,519	6	Double circuit	Archbold-Brady	Cu.	500,000	156	40	42	900
20,000	6	Double circuit	Archbold-Brady	A.C.S.R.	795,000 (30%)	156	40	42	900
20,000	6	Double circuit	Riter-Conley	A.C.S.R.	795 000 (30%)	156	40	42	900
20,000	6	Double circuit	Riter-Conley	A.C.S.R.	795,000 (30%)	156	40	42	900
20,000	6	Double circuit	Riter-Conley	A.C.S.R.	795,000 (30%)	156	40	42	900
17,000	10	2-circ. 26 kv.; 2-circ. 132 kv.	Riter-Conley	A.C.S.R.	795,000 (30%)	156	40	36	500
16,000	5	Single circuit	Riter-Conley	A.C.S.R.	795,000 (40%)	342	30; city 40	72	1,100
6,749; 9,652; 10,119	6.2		Lehigh, R.-C.	A.C.S.R.	No. 0000	125.4	27		Ave. 855
6,990; 8,725; 10,000	7.0		Lehigh Structure	A.C.S.R.	No. 0000	125.4	27		Ave. 755
9,400	7	Suspension	Lehigh	H.d. strand Cu.	167,772	96	21	44	880
6,200	26	Dead end	Coombs	H.d. strand Cu.	83,694	72	21	30	200
	10	H-frame suspension		H.d. strand Cu.	211,600	132	21	44	615
	33			H.d. strand Cu.	167,772	86	21	10	163
9,400	7	Suspension	Coombs	H.d. strand Cu.	211,600	96	21	41	880
9,400	8	Suspension	Coombs	H.d. strand Cu.	167,772	96	21	31	880
	32			H.d. strand Cu.	83,694	72	27	26	150
	24			Cu.	133,100	108—72—130	25	34	220
	26			Cu.	133,100	108—72—130	25	34	200
				Cu.	66,500	84—119—84	25	34	150
7,275; 10,300; 14,150	7.7		Riter-Conley	A.C.S.R.	No. 0000	122	25	40	693
	30			A.C.S.R.	No. 0000	42—36—36—42			
	30			Cu.	133,100	58—36—48			
	9	Steel arm w. p.; H-frame 55 ft. poles		A.C.S.R.	No. 0000	153	27	37	575
7,275; 10,300; 14,150	7		Riter-Conley	A.C.S.R.	336,400	122	27	39	740
30,000; 307,500	8.8	4 circuit towers and bridges	B.-K.; Belmont	Stranded Cu.	500,000	138	45	42	600
8,050; 29,082	7.1	Double circuit, wide base	Lehigh Structure	Stranded Cu.	500,000	120	30	42	800
11,062; 36,880	5.8	Single circuit, square base	Blaw-Knox	A.C.S.R.	795,000	306	31.5	96; (acid 72)	1,250
45,000; 90,000	6.9	Combination 66 and 220 kv.	Blaw-Knox	A.C.S.R.	(11)	(11)	31.5	(11)	1,250
14,690; 36,880	4.5	Single circuit, square base	B.-K.; A.-B.	A.C.S.R.	795,000	306	31.5	96; (acid 72)	1,250
7,010; 21,450	6.7	Double circuit, wide base; special nar. base	Blaw-Knox	A.C.S.R.	477,000	156	35	42	1,000
6,900; 16,000	11.4	Narrow base, latticed steel poles; wide ba. tws.	Coombs	Stranded Cu.	133,100	114	30	36	500
7,010; 30,000	10.3	D'ble circ., wide base and spec. narrow base	Blaw-Knox	A.C.S.R.	397,500	156	35	42	800
25,000 avg.	6	American bridge standard earth anchor	American Bridge	A.C.S.R.	397,500	108	30	36	1,000
	28	Wood pole (single)		A.C.S.R.	No. 4/0 211,000	84	25	42	350
	10	H-frame cedar pole		H.d. Cu.	No. 2/0	144	22	30	540
13,000	6	Double circuit 4 leg	Blaw-Knox	A.C.S.R.	No. 4/0	96	24	32	880
	10	H-frame cedar poles		H.d. Cu.	No. 2/0	144	22	32	528
11,000	8	Double circuit 4 leg	American Bridge	H.d. Cu.	No. 2/0	96	22	32	660
15,000	4.1	Double circuit 4 leg	Riter-Conley	A.C.S.R.	No. 4/0	120	24	36	1,200
None	10	H-frame cedar pole		H.d. Cu.	No. 2/0	144	23	36	528
	10	H-frame cedar pole		H.d. Cu.	No. 2/0	144	23	32	528
None	7	H-frame cedar poles		H.d. Cu.	No. 4/0	158	24	38	750
None	7.5	H-frame cedar poles		H.d. Cu.	No. 4/0	144	24	36	700
10,000	9	B. E. & M. Corp. "A"	McClintock	Cu.	500	198	30	45, max. defl.	800
10,000—14,000	7.76	Rigid	American Bridge and others	Cu. and A.C.S.R.	300 and No. 4/0 Cu., 4/0 Al.	192 (108 vert.)	25	45, max. defl.	766
9,600; 15,000	9.9		Blaw-Knox	H.d. strand Cu.	211,600		30	60	545
9,600; 15,000	9.5	Sq. base, 4-way batter to low 132 kv. arm; vertical faces above.	Blaw-Knox	H.d. strand Cu.	211,600	156 vertical;		60	574
9,600; 15,000	8.4		Blaw-Knox	H.d. strand Cu.	211,600	264 horizontal	Steel, 38,	60	630
10,100; 15,000	7.6		Blaw-Knox	H.d. strand Cu.	211,600	between circuits	wood 25;	60	660
9,600; 15,000	8.4		Blaw-Knox	H.d. strand Cu.	211,600		provision	60	626
10,100; 15,000	8.6	Same as line No. 110. Towers as No. 101	Blaw-Knox	H.d. strand Cu.	211,600	164; (st'l 156)	for 25 kv.	77 (60)	614 (steel 695)
9,600; 15,000	6.6		Blaw-Knox	H.d. strand Cu.	211,600	156 vert.; 264 horiz.	and tel.	60	800
10,100; 15,000	8.1	Same as line No. 101	Blaw-Knox	H.d. strand Cu.	211,600	156	circuit	60	615
9,600; 15,000	8.4		Blaw-Knox	H.d. strand Cu.	211,600	156 vert.; 264 horiz.		60	626
	8.2	2-pole H-frame; 3-pole dead ends		H.d. strand Cu.	211,600	265	25	Susp. 67;	624
	8.1		None	H.d. strand Cu.	211,600	265	25	dead end 46	651
	18			A.C.S.R.	477,000	72x96x120	25	36	300
3,000; 7,500	13	Flexible steel pole	Archbold-Brady	A.C.S.R.	477,000	84	25	36	400
	18			A.C.S.R.	477,000	72x96x120	25	36	300
7,600; 14,700	6	Double circuit	American Bridge	A.C.S.R.	336,400	144	25	48	800
7,600; 14,700	6	Double circuit	American Bridge	A.C.S.R.	336,400	144	25	48	880
7,600; 14,700	6	Double circuit	American Bridge	A.C.S.R.	336,400	144	25	48	880
8,900; 19,100	6	Double circuit	American Bridge	A.C.S.R.	336,400	144	25	48	880
7,600; 14,700	6	Double circuit	American Bridge	A.C.S.R.	336,400	144	25	48	880
8,900; 19,100	6	Double circuit	American Bridge	A.C.S.R.	336,400	144	25	48	880
	34	W. R. C. class A pole		Cu. solid	No. 1/0		35		150
Al. 8,900; 19,100; Cu. 6,440; 14,200	Al. 6, Cu. 7.5	Double circuit	American Bridge	A.C.S.R., Cu. str.	Al. 336,400; Cu. 211,600	144	25	48	Al. 880; Cu. 700
7,600; 14,700	6	Double circuit	American Bridge	A.C.S.R.	336,400	144	25	48	880
7,600; 14,700	6	Double circuit	American Bridge	A.C.S.R.(3)	336,400	144	25	48	880
	17.6	Single pole		Cu. stranded	No. 2/0	84	22	15	350
	39			H.d. Cu.	No. 1/0	60	27	36	140
	456p.; 5t.	X. and Y. and wood poles	American Bridge	H.d. Cu.	No. 1/0	60	27	48	145
7,000	20	X. and Y.	American Bridge	H.d. Cu.	No. 1/0	74	27		300
7,000	27	A. B. C.	American Bridge	A.C.S.R.	266,800	144	27	60	300, 900
	11	A. B. C.	American Bridge	M.h.d. Cu.	300,000	156			450
14,000	6	A. B. C.	American Bridge	Al. A.C.S.R.	266,800	144—158	27	132	900
14,000	5	A. B. C.	American Bridge	Cu.	300,000	156, 168	27	132	1,000
14,000	5	A. B. C.	American Bridge	Cu.	300,000	156, 168	27	132	1,000
	5	A. B. C.	American Bridge	Cu.	300,000	156, 168			1,000
14,000	5	A. B. C.	American Bridge	Cu. M.H.D.	300,000	156, 168	27	132	1,000
	8	2 pole H, 3-pole angle, 4-pole special		A.C.S.R.	211,600	126	25	33	900
12,000	11	2-circuit	American Bridge	H.d. Cu.	250,000	90 and 96	30	30	500
54,900	8	6-circuit	American Bridge	H.d. Cu.	250,000	120	35	30	850
17,926	7	2-circuit	American Bridge	H.d. Cu.	250,000	102	35	30	850
9,125	7	2-circuit	American Bridge	M.h.d. stranded Cu.	211,600	96	25	50	750
8,075	8	2-circuit	American Bridge	M.h.d. stranded Cu.	211,600	44	25	64	700
	26			H.d. Cu.	211,600	72, 104 H	30	30	200
	18			Cu.	300,000	84—96—120	25	36	300
	18			A.C.S.R.	477,000	84—96—120	25	36	300
	18			A.C.S.R.	477,000	84—96—120	25	36	300
11,720; 20,330	4	Rigid square base	Blaw-Knox	Cu.	400,000	144	30	48	1,200
11,720; 20,330	4	Rigid square base	Blaw-Knox	Cu.	400,000	144	30	48	1,200
23,000; 30,000	8.6	Square base rigid	Riter-Conley	A.C.S.R.	397,500	156	30	40	786
	18			Cu.	No. 2/0	84x96x120	25	36	300
	25			A.C.S.R.	477,000	84x96x120	25	36	200
	25			A.C.S.R.	477,000	84x96x120	25	30	200
11,720; 20,330	4	Rigid square base	Blaw-Knox	Cu.	400,000	144	30	48	1,200
11,720; 20,330	4	Rigid square base	Blaw-Knox	Cu.	400,000	144	30	48	1,200
12,630; 20,920	6.18	Square base rigid	Blaw-Knox	A.C.S.R.	397,500	156	30	36	920
8,025 standard suspension	30	45 ft. W. R. C. and creosote pine		7 strand Cu.	133,225	83.88 equiv.	25	30	175
	27	45 foot W. R. C. poles		7 strand Cu.	133,225	83.88 equiv.	25	30	200
	30	45 foot W. R. C. poles		7 strand Cu.	133,225	83.88 equiv.	25	30	175
10,790	7 T., 30 P.	2 circuit angle	Blaw-Knox	A.C.S.R.	No. 4/0	201.64 T.; 83.16 P.	25	30	175 P.; 800 T.
line 13,600 standard suspension	5.2	2 circuit suspension	Riter-Conley	A.C.S.R.	397,500	156	25	38 (45° swing)	1,000
8,025 standard suspension	6.6	2 circuit suspension	Blaw-Knox	19 strand Cu.	211,600	132	25	35 (45° swing)	800
13,600 standard suspension	5.2	2 circuit suspension	Riter-Conley	A.C.S.R.	397,500	156	25	38 (45° swing)	1,000
8,025 standard suspension	6.6	2 circuit suspension	Blaw-Knox	19 strand Cu.	211,600	132	25	35 (45° swing)	800
	30	45 foot W. R. C. poles		7 strand Cu.	133,225	83.88 equiv.	25	30	175
	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)
2,740	10		Bates	A.C.S.R.	167,805	84	22	72	500
	17			A.C.S.R.	167,805	84	22	48	300
	15			A.C.S.R.	167,805	84	24	48	350
5,190	7	Double circuit	American Bridge	A.C.S.R.	167,805	96	22	72	750
	17			A.C.S.R.	167,805	84	22	48	200
	17			A.C.S.R.	211,600	84	23	48	300
	17			A.C.S.R.	167,805	84	22	42	300
	35	40 foot W. R. C. poles		7 strand Cu.	105,625	83.88 equiv.	22	30	150
	27	45 foot W. R. C. poles		7 strand Cu.	133,225	83.88 equiv.	25	30	200
	35	40 foot W. R. C. poles		7 strand Cu.	133,225	83.88 equiv.	22	30	150
	35	45 foot W. R. C. poles		7 strand Cu.	133,225	78.24 equiv.	25	30	150
	35	45 foot W. R. C. poles		7 strand Cu.	133,225	83.88 equiv.	25	30	150
	27	45 foot W. R. C. poles		7 strand Cu.	133,225	83.88 equiv.	25	30	200
16,000 Ave.	5.33	Suspension, strain, transposition	Riter-Conley	A.C.S.R. 30 and 7 strand	397,500	160	28	43	1,000
17,200 Ave.	5.33 Ave.	Suspension, strain, transposition	Riter-Conley	19 strand hard drawn Cu.	300,000	160	35	47	700, 1,000
16,500 Ave.	5.54	Suspension, strain, transposition	Riter-Conley	A.C.S.R. 30 and 7 strand	397,500	160	28	43	1,000
	30	45 foot W. R. C. poles		7 strand Cu.	133,225	83.16 equiv.	25	30	175
	27	45 foot W. R. C. poles		7 strand Cu.	133,225	83.88 equiv.	25	30	200
	30	45 foot W. R. C. poles		7 strand Cu.	133,225	83.88 equiv.	25	30	175
	30	45 foot W. R. C. poles		7 strand Cu.	133,225	83.88 equiv.	25	30	175
	21	50 foot W. R. C. poles		7 strand Cu.	133,225	107.16	25	36	250
	30	45 foot W. R. C. poles		7 strand Cu.	133,225	83.16 equiv.	25	30	175
	22			A.C.S.R.	No. 4/0	72 vert.; 120 horiz.	20	34	240
	22			A.C.S.R.	No. 4/0	72 vert.; 120 horiz.	20	34	240
3,550; 5,800; 6,350	7.5	Wide base 4 leg	Aermotor	A.C.S.R.	No. 3/0	84 v.; 156 and 228 h.	20	30	700
3,550; 5,800; 6,350	7.5	Wide base 4 leg	Aermotor	A.C.S.R.	No. 3/0	84 v.; 156 and 228 h.	20	30	700
4,350; 6,785; 8,175	7	Wide base 4 leg	Aermotor	A.C.S.R.	397,500	102 v.; 180 and 252 h.	20	40	750
8,780; 15,945; 17,635	6	Wide base	Riter-Conley	Cu.	300,000	156	25	48	880
5,000	7	Square	Water Bates Steel	A.C.S.R.	No. 4/0	96; 2' offset	24	28	750
8,000	6.25	Square	Riter-Conley	Cu.	350,000	96; 2' offset	30	32	800
5,000	13	A-frame	Riter-Conley	Cu.	No. 1/0	72	25	28	400
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Thomas	No	Small round horn	None	Solid clamp, No. 4/0	Cu. sleeves	None		Siemens-Martin galv	
	No	Small round horn	None	Solid clamp, No. 4/0	Cu. sleeves	None		Siemens-Martin galv	

	25	34	660	21	1,350	Vertical	110,000	6 or 7	Hewlett	Thomas	7 or 8	Hewlett	Th
	25	34	660	21	1,350	Vertical	110,000	6 or 7	Hewlett	Thomas	7 or 8	Hewlett	Th
	25	34	660	21	1,350	Vertical	110,000	6 or 7	Hewlett	Thomas	7 or 8	Hewlett	Th
	25	34	660	21	1,350	Vertical	110,000	6 or 7	Hewlett	Thomas	7 or 8	Hewlett	Th
	25	34	660	21	1,350	Vertical	110,000	6 or 7	Hewlett	Thomas	7 or 8	Hewlett	Th
	25	34	660	21	1,350	Vertical	110,000	6 or 7	Hewlett	Thomas	7 or 8	Hewlett	Th
Pole 18; t'r 25	42	300; 500; 650	4; 4; 8.5 Cu.	1,800; A.C.S.R. 2,000	Vertical	110,000	8	Cap and pin No. 8,400	Locke	9	Cap and pin No. 8,400	Lo
	25	30	500	14	720; 2,500 maximum	Vertical	66,000	5	Cap and pin	Locke	6	Cap and pin	Lo
	25	42	660	16.5	2,100; 5,000 maximum	Vertical	110,000	8	Cap and pin	Locke	9	Cap and pin	Lo
	25	42	660	16.5	2,100; 5,000 maximum	Vertical	110,000	8	Jeffery-Dewitt No. A-257	Jeffery-Dewitt	9	Jeffery-Dewitt No. A-257	Jeffery
	25	30	500	14	720; 2,500 maximum	Vertical	66,000	5	Jeffery-Dewitt No. A-257	Jeffery-Dewitt	6	Jeffery-Dewitt No. A-257	Jeffery
	25	42	700	11	1,600; 5,000 maximum	Vertical	110,000	8	Hewlett link No. 11,029	Thomas	2x9	Hewlett link No. 11,029	Th
	20	30	250	4	600; 2,000 maximum	Vertical	66,000	3	Jeffery-Dewitt	Jeffery-Dewitt	5	Jeffery-Dewitt	Jeffery
	22	30	360	2.8	950; 2,500 maximum	Vertical	66,000	4	Jeffery-Dewitt No. A-257	Jeffery-Dewitt	4	Jeffery-Dewitt No. A-257	Jeffery
	20	34	400	9	3,200 winter	Horisontal	110,000	8	Suspension disc	Locke No. 5,800	9	Suspension disc	Locke
	25	.....	300	.....	.....	.....	.....	6	Suspension	Locke, J.-D.	7	Suspension	Lo
	25	.....	550	.....	.....	.....	.....	5	Suspension	Locke, J.-D.	6	Suspension	Locke
	21	.....	500	.....	.....	.....	.....	6	Suspension	Locke, J.-D.	7	Suspension	Locke
	25	.....	500	.....	.....	.....	.....	6	Suspension	Locke, O. B.	7	Suspension	Locke
	25	.....	550	.....	.....	.....	.....	8	Suspension	Locke, J.-D.	9	Suspension	Lo
	40	42	800	23	2,650	Vertical; middle conductor offset out 3 ft.	132,000	10	No. 2,300	Lapp	12	No. 2,094	La
	40	42	900	54	2,860		132,000	10	No. 25,622	Ohio Brass	12	No. 26,240	Ohio
	40	42	900	33.5	3,100		132,000	9	No. 5,960	Lapp	11	No. 2,094	La
	40	42	900	33.5	3,100		132,000	9	No. 641	Westinghouse	11	No. 635	Westin
	40	42	900	33.5	3,100		132,000	9	No. 184,400	Locke	11	No. 18,424	Lo
	40	42	900	33.5	3,100		132,000	9	No. 641	Westinghouse	11	No. 635	Westin
	40	36	500	7	4,560	Vert.; 2 ft. offset	132,000	9	No. 641	Westinghouse	2x11	No. 641 (double string)	Westin
30; city 40	72	1,100	30	6,300	Horisontal		220,000	16 (prov'n for 18)	No. 18,424	Locke	18 (Prov'n for 20)	No. 18,424 (triple string)	Lo
	27	.....	Ave. 855	.....	.....	Vert. offset 155.4" equiv.	110,000	7	Cap and pin No. 25,622	Ohio Brass	Double string 9	Cap and pin No. 25,622	Ohio
	27	.....	Ave. 755	.....	.....		110,000	8	Hewlett No. 1,054	Thomas	Double string 9	Hewlett No. 1,054	Th
	21	44	880	46	1,820	Vertical	75,000	5 and 6	Disc No. 25,622	Ohio Brass	2—6 each	Disc No. 25,622	Ohio
	21	30	200	2	800	Vertical	75,000	5	Ohio Brass No. 25,622	Ohio Brass	6	Ohio Brass No. 25,622	Ohio
	21	44	615	14	2,190	Horisontal	75,000	5	Lapp No. 5,960 disc	Lapp	6	Lapp No. 5,960	La
	21	10	163	2.5	700	Horisontal	70,000	1	Pin No. 10,748	Ohio Brass	6	Lapp No. 5,960	La
	21	41	880	32	1,950	Vertical	105,000	7	Ohio Brass No. 25,620	Ohio Brass	8	Ohio Brass No. 25,620	Ohio
	21	31	880	35	1,450	Vertical	75,000	5	Ohio Brass No. 25,620	Ohio Brass	6	Ohio Brass No. 25,620	Ohio
	27	26	150	1.25	700	Vertical	75,000	5	Disc No. 25,622	Ohio Brass	6	Disc. No. 25,622	Ohio
-130	25	34	220	.....	.....	△ equiv. 100.5"	66,000	5	Hewlett No. 1,054	Thomas	6	Hewlett No. 1,054	Th
-130	25	34	200	.....	.....	△	66,000	5	Hewlett No. 1,054	Thomas	6	Hewlett No. 1,054	Th
-84	25	34	150	.....	.....	△	66,000	5	Hewlett No. 1,054	Thomas	6	Hewlett No. 1,054	Th
	25	40	693	.....	.....	Vertical	66,000	Pin	3 and 4 parts	Various	Double arm	.....	.....
-42	.....	.....	.....	.....	5,000	Vertical	66,000	Pin	3 and 4 parts	Various	Double arm	.....	.....
-48	.....	.....	.....	.....	.....	Vertical	110,000	7	Cap, pin; No. 25,622	Ohio Brass	2x9	No. 25,622	Ohio
	27	37	575	.....	.....	Hori. equiv. 193"	110,000	7	Hewlett No. 1,054	Thomas	2x9	Hewlett No. 1,054	Th
	27	39	740	.....	.....	Vertical							
	45	42	600	15.15	4,600	Vertical	66,000	9	W'hse No. 641; Locke 18,400	W'hse; Locke	9	(Dead end construction throughout)	
	30	42	800	17.06	7,250	Vertical	66,000	8	Suspension No. 635	Westinghouse	9	High strength	Westin
	31.5	96; (acid 72)	1,250	39.5	6,200	Horisontal	220,000	16	High strength No. 635	Westinghouse	3x18	High strength No. 635	Westin
	31.5	(11)	1,250	39	5,300	Horisontal	66,000 and 220,000	8; 14	Double string high strength	No. 6,194 Lapp	3x9; 3x16	High strength No. 6,194	La
	31.5	96; (acid 72)	1,250	39.5	6,200	Horisontal	220,000	14	W'hse No. 635; Lapp No. 6,194	W'hse; Lapp	3x16	W'hse No. 635; Lapp No. 6,194	W'hse
	35	42	1,000	18.2	5,000	Vertical	66,000	8, 10	O. B. No. 25,620; Fr. No. 2,522	O. B.; Franklin	2x12	Ohio Brass No. 26,240	Ohio
	30	36	500	11.4	1,100	Vertical	66,000	8	No. 25,620	Ohio Brass	9	No. 25,620	Ohio
	35	42	800	11.6	4,200	Vertical	66,000	8	No. 25,620; No. 2,522	O. B.; Franklin	10; d'd end 2x12	No. 25,620	Ohio
	30	36	1,000	22	6,000	Vertical	80,000	6	No. 25,622		2x7	No. 25,622	Ohio
	25	42	350	40	4,000 maximum	△	75,000	5	No. 5,800	R. Thomas	5	.....	.....
	22	30	540	15	3,140	Horisontal	110,000	8	10" disc	Ohio Brass	9	10" disc	O. B.
	24	32	880	18	5,000	Vertical	110,000	6	10" disc flux control	Ohio Brass	10	10" disc	Ohio
	22	32	528	15	3,140	Horisontal	66,000	5	10" disc	Ohio Brass	6	10" disc	Ohio
	22	32	660	23	3,140	Vertical	66,000	6	10" disc	Ohio Brass	7	10" disc	Ohio
	24	36	1,280	35	5,000	Vertical	110,000	9	10" disc	Ohio Brass	10	10" disc	Ohio
	23	36	528	15	3,140	Horisontal	110,000	8	10" disc	Westinghouse	9	10" disc	Westin
	23	32	528	15	3,140	Horisontal	110,000	8	10" disc	Westinghouse	9	10" disc	Westin
	24	38	750	23	.....	Horisontal	132,000	10	10" disc	Westinghouse	11	10" disc	Westin
	24	36	700	20	.....	Horisontal	110,000	8	10" disc	Ohio Brass	9	10" disc	Ohio
rt.)	25	45, max. defl.	985	.....	4,600	Horisontal	75,000	6	Suspension No. 2,094	Lapp	7	Suspension No. 2,094	La
	25	45, max. defl.	766	.....	4,575	Vertical	75,000	6	Susp. O. B. 25,620, No. 2,094	Ohio Brass; Lapp	7	Suspension No. 25,620, 2,094	O. B.
al;	30	60	545	11.5	2,200	Vertical	132,000	10	Disc	Ohio Brass	2x11	Disc	Ohio
ntal	Steel, 38,	60	574	12.4	2,200	Vertical	132,000	9	Disc	Jeffery-Dewitt	2x10	Disc	Jeffery
cuits	wood 25;	60	630	15.2	2,200	Vertical	132,000	9	Disc	Jeffery-Dewitt	2x10	Disc	Jeffery
	provision	60	660	16.7	2,200	Vertical	132,000	9	Disc	Jeffery-Dewitt	2x10	Disc	Jeffery
	for 25 kv.	60	626	15.2	2,200	Vertical	132,000	9	Disc	Jeffery-Dewitt	2x10	Disc	Jeffery
156)	77 (60)	614 (steel 695)	14 (19)	2,200	Hori. (steel vert.)	132,000	8 (steel 9)	Disc	Jeffery-Dewitt	2x9	Disc	Jeffery
horis.	and tel.	60	800	25.2	2,200	Vertical	132,000	9	Disc	Jeffery-Dewitt	2x10	Disc	Jeffery
	circuit	60	615	14.1	2,200	Vertical	132,000	9	Disc	Jeffery-Dewitt	2x10	Disc	Jeffery
horis.		60	626	15.2	2,200	Vertical	132,000	9	Disc	Jeffery-Dewitt	2x10	Disc	Jeffery
	25	Susp. 67;	624	15	2,200	Horisontal	132,000	9	Disc	Westinghouse	2x10	Disc	Westin
	25	dead end 46	651	16.2	2,200	Horisontal	132,000	9	Disc	Westinghouse	2x10	Disc	Westin
20	25	36	300	4.25	1,325, 4,500 ult. el. B load	△	66,000	5	Cap & pin susp. No. 25,630	Ohio Brass	6	Cap and pin susp. No. 26,240	Ohio
20	25	36	400	7.5	1,350, 4,500 ult. el. B load	Vertical	66,000	6	Cap & pin susp. No. 25,620	Ohio Brass	7	Cap and pin susp. No. 26,240	Ohio
	25	36	300	4.25	1,325, 4,500 ult. el. B load	△	66,000	5	Cap & pin susp. No. 25,620	Ohio Brass	6	Cap and pin susp. No. 26,240	Ohio
	25	48	800	17	3,100	Vertical	132,000	10	Susp. & 10" disc No. 25,620	Ohio Brass	10	Str. susp. 11" disc. No. 26,240	Ohio
	25	48	880	17	3,100	Vertical	132,000	10	Susp. 10" disc No. 25,620	Ohio Brass	10	Str. susp. 11" disc. No. 26,240	Ohio
	25	48	850	18	2,900	Vertical	66,000	6	Susp. 10" disc No. 71,035	Ohio Brass	6	Str. susp. 11" disc No. 26,240	Ohio
	25	48	880	18	2,900	Vertical	132,000	10	Susp. 10" disc No. 25,620	Ohio Brass	10	Str. susp. 11" disc No. 26,240	Ohio
	25	48	880	17	3,100	Vertical	132,000	10	Susp. 10" disc No. 25,620	Ohio Brass	10	Str. susp. 11" disc No. 26,240	Ohio
	25	48	880	18	2,900	Vertical	132,000	10	Susp. 10" disc No. 25,620	Ohio Brass	10	Str. susp. 11" disc No. 26,240	Ohio
.....	35	.....	150	1.5	600	Vert. and hori.	66,000	.....	Pin	Ohio Brass	6	10" disc	Ohio
	25	46	Al. 880; Cu. 700	Al. 18.0; Cu. 22.8	Al. 2,900; Cu. 1,750	Vertical	132,000	10	Susp. 10" disc No. 25,620	Ohio Brass	10	Str. susp. 11" disc No. 26,240	Ohio
	25	48	880	17	3,100	Vertical	132,000	10	Susp. 10" disc No. 25,620	Ohio Brass	10	Str. susp. 11" disc No. 26,240	Ohio
	25	48	880	17	3,100	Vertical	132,000	10	Susp. 10" disc No. 25,620	Ohio Brass	10	Str. susp. 11" disc No. 26,240	Ohio
	22	15	350	5	1,260	△	66,000	1	Pin	Ohio Brass	6	10" disc	Ohio
	27	36	140	.....	1,500	Horisontal	66,000	.....	Pin Ohio Brass No. 10,748	Ohio Brass	6	Ohio Brass disc	Ohio
	27	48	145	.....	1,500	Horisontal	66,000	1	Pin	Ohio Brass	6	Ohio Brass disc No. 25,620	Ohio
	27	.....	300	.....	1,800	Vertical	66,000	5	Hewlett No. 9,140; W'hse 601	Locke	6	Hewlett No. 9,140; W'hse 601	Lo
	27	60	300, 900	.....	5,000	Vertical	66,000	5	Locke No. 8,400	Locke	6	Locke No. 8,400	Lo
	.....	.....	450	.....	6,000	△	132,000	10	Locke-Hewlett No. 9,140	Locke	11	Locke-Hewlett No. 9,140	Lo
	27	132	900	.....	5,000	Vertical	66,000	5	Locke 8400	Locke	6	Locke No. 8,700	Lo
	27	132	1,000	.....	6,000	Vertical	132,000	9	Locke-Hewlett No. 9,140	Locke	10	Locke-Hewlett No. 9,140	Lo
	27	132	1,080	.....	6,000	Vertical	132,000	10	Ohio Brass No. 25,620	Ohio Brass	11	Ohio Brass No. 25,620	Ohio
	.....	.....	1,000	.....	6,000	Vert. to T. 184;	132,000	10	Locke-Hewlett No. 9,140	Locke	11	Locke-Hewlett No. 9,140	Lo
	27	132	1,000	.....	6,000	H. to end of line	132,000	10	Locke No. 9,140	Locke	11	Locke-Hewlett No. 9,140	Lo
	25	33	900	27	1,080	Horisontal	66,000	5	10" suspension disc	Ohio Brass	6	10" suspension disc	Ohio
96	30	30	500	12	1,950	Vertical	69,000	5	Suspension	Ohio Brass	6	Suspension	Ohio
	35	30	850	35.35	1,950	Vertical	69,000	6	Suspension	Ohio Brass	6	Suspension	Ohio
	35	30	850	35.35	1,950	Vertical	69,000	5	Suspension	Ohio Brass	6	Suspension	Ohio
	25	50	750	25.2	1,700	Vertical	69,000	5	Suspension	Ohio Brass	6	Suspension	Ohio
	25	64	700	22.4	1,700	Vertical	132,000	9	Suspension	Jeffery-Dewitt	11	Suspension	Jeffery
H	30	30	200	2	1,700	△	69,000	5	Suspension	Ohio Brass	6	Suspension	Ohio
120	25	36	300	3.95	2,640; 5,000 at B loading	△	66,000	5	Cap & pin susp. No. 25,620	Ohio Brass	6	Cap and pin susp. No. 26,240	Ohio
120	25	36	300	4.25	1,325; 4,500 B	△	66,000	4, 5	J.-D. susp.; cap & pin susp.	J.-D.; O. B.	5, 6	Jeffery-Dewitt & O. B. susp.	J.-D.
120	25	36	300	4.25	1,325; 4,500 B	△	66,000	4, 5	J.-D. susp.; cap & pin susp.	J.-D.; O. B.	5, 6	J.-D. susp and cap & pin susp.	J.-D.
	30	48	1,200	42.7	5,180; 9,400 B	Vertical	66,000	7(8)	Cap & pin susp. No. 25,620	Ohio Brass	7(8)	Cap and pin susp. No. 26,240	Ohio
	30	48	1,200	42.7	5,180; 9,400 B	Vertical	66,000	8	Cap & pin susp. No. 25,620	Ohio Brass	8	Cap and pin susp. No. 26,240	Ohio
	30	40	786	14.5	3,300	Vertical	132,000	9	Ball socket No. 25,630	Ohio Brass	11	Ball socket No. 26,240	Ohio
20	25	36	300	3.95	1,150; 2,760 B	△	66,000	4	Jeffery-Dewitt susp. A-257	Jeffery-Dewitt	5	Jeffery-Dewitt susp. A-257	Jeffery
20	25	36	200	1.75	1,470; 4,500 B	△	66,000	4	Jeffery-Dewitt susp. A-257	Jeffery-Dewitt	5	Jeffery-Dewitt susp. A-257	Jeffery
20	25	30	200	1.75	1,470; 4,500 B	△	66,000	4	Jeffery-Dewitt susp. A-257	Jeffery-Dewitt	5	Jeffery-Dewitt susp. A-257	Jeffery
	30	48	1,200	42.7	5,180; 9,400 B	Vertical	66,000	7(8)	Cap & pin susp. No. 25,620	Ohio Brass	7(8)	Cap and pin susp. No. 26,240	Ohio
	30	48	1,200	42.7	5,180; 9,400 B	Vertical	66,000	7(8)	Cap & pin susp. No. 25,620	Ohio Brass	7(8)	Cap and pin susp. No. 26,240	Ohio
	30	36	920	20.5	3,350	Vertical	66,000	6	Ball socket susp. No. 25,620	Ohio Brass	6	Ball socket susp. No. 26,240	Ohio
iv.	25	30	175	1.83	900	"L" configuration	66,000	1 P.; 6 T.	Pin, poles; susp. 25,622 on twrs	Ohio Brass	4 on P. 7 on T.	No. 25,622 suspension	Ohio
iv.	25	30	200	2.08	950	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio
iv.	25	30	175	1.83	900	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio
.16 P.	25	30	175 P.; 800 T.	1 P.; 23 T.	600 P.; 1,000 T.	Vertical	66,000	6	Pin, poles; disc, towers	Ohio Brass	8	Suspension	Ohio
	25	38 (45° swing)	1,000	23.7	3,300	Vertical	132,000	9	Suspension No. 25,620	Ohio Brass	11	No. 26,240 suspension	Ohio
	25	35 (45° swing)	800	23.9	2,180	Vertical	132,000	9	No. 25,622 suspension	Ohio Brass	11	No. 25,622 suspension	Ohio
	25	38 (45° swing)	1,000	23.7	3,300	Vertical	132,000	9	No. 25,620 suspension	Ohio Brass	11	No. 26,240 suspension	Ohio
	25	35 (45° swing)	800	23.9	2,180	Vertical	132,000	9	No. 25,622 suspension	Ohio Brass	11	No. 25,622 suspension	Ohio
iv.	25	30	175	1.83	900	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 22,622 suspension	Ohio
	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	
	22	72	500	3.17	1,200	Vertical	90,000	6	Suspension	Lapp No. 2,300	7	Suspension	La
	22	48	300	2.33	1,200	Horisontal	75,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio
	24	48	350	3.75	1,200	Horisontal	75,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio
	22	72	750	16	1,300	Vertical	90,000	6	Suspension No. 25,622	Ohio Brass	7	Suspension No. 25,620	Ohio
	22	48	200	2.33	1,200	Horisontal	75,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio
	23	48	300	2.33	1,200	Horisontal	75,000	5	Suspension	Westinghouse	6	Suspension	Westin
	22	42	300	2.33	1,200	Horisontal	75,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio
iv.	22	30	150	1.5	750	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio
iv.	25	30	200	2.08	950	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio
iv.	22	30	150	1.5	750	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio
iv.	25	30	150	1.5	750	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio
iv.	25	30	150	1.5	750	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio
iv.	25	30	200	2.08	950	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio
	28	43	1,000	26.25	2,950	Vertical	550,000(33)	8 and 9	Jeffery-Dewitt A-257	Jeffery-Dewitt	8 and 9(34)	Jeffery-Dewitt A-257	Jeffery
	35	47	700, 1,000	18.84, 26.45	2,975	Vertical	550,000(33)	8 and 9	Jeffery-Dewitt A-257	Jeffery-Dewitt	8 and 9(34)	Jeffery-Dewitt A-257	Jeffery
	28	43	1,000	26.25	2,950	Vertical	550,000(33)	8 and 9	Jeffery-Dewitt A-257	Jeffery-Dewitt	8 and 9(34)	Jeffery-Dewitt A-257	Jeffery
iv.	25	30	175	1.83	900	Vertical	66,000	1	Pin	Ohio Brass	6	No. 25622 suspension	Ohio
iv.	25	30	200	2.08	950	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio
iv.	25	30	175	1.83	900	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio
iv.	25	30	175	1.83	900	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio
	25	36	250	2.92	1,050	"L" configuration	66,000	5	Franklin suspension	E. S. supplies	5	Franklin suspension	E. S.
iv.	25	30	175	1.83	900	Vertical	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio
horis.	28	54	240	1.8	1,200	Vert. and hori.	66,000	5	Hewlett	Thomas	6	Hewlett	Th
horis.	28	54	240	1.8	1,200	Vert. and hori.	66,000	5	Hewlett	Thomas	6	Hewlett	Th
228 h.	30	50	700	8.5	1,650	Vertical	66,000	5	Hewlett	Thomas	6	Hewlett	Th
228 h.	30	50	700	8.5	1,650	Vertical	66,000	5	Hewlett	Locke	6	Hewlett	Lo
d 252 h.	20	40	750	14	2,500	Vertical	66,000	5	Cem. cap ball and socket	Ohio Brass	6	Cemented cap ball and socket	Ohio
	25	48	880	31	2,920	Vertical	580,000	8	A-257	Jeffery-Dewitt	9	A-257	Jeffery
et	24	28	750	21	4,000	Vertical	70,000	6	No. 25,622	Ohio Brass	7	No. 25,622	Ohio
et	30	32	800	24	7,400	Vertical	70,000	7	No. 2,094 and No. 5,960	Lapp	8	No. 2,094 and 5,960	La
	25	28	400	12	3,000	Vertical	70,000	6	No. 25,620	Ohio Brass	8	No. 25,620	Ohio
et	24	28	660	26	3,000	Vertical	70,000	6	No. 5,960	Lapp	8	No. 5,960	La
	Hewlett	Thomas	7 or 8	Hewlett	Thomas	No	.....	.....	.....	.....	.....	.....	
or 7	Hewlett	Thomas	7 or 8	Hewlett	Thomas	No	.....	Small round horn	None	.....	Solid clamp, No. 4/0		
or 7	Hewlett	Thomas	7 or 8	Hewlett	Thomas	No	.....	Small round horn	None	.....	Solid clamp, No. 4/0		

| | | |

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

		Cu. sleeves	None		Siemens-Martin galv.	5/16	1	None		36
		Cu. sleeves	None		Siemens-Martin galv.	5/16	1	None	General Electric carrier, wireless	37
		Cu. sleeves	None		Siemens-Martin galv.	4/6	1	None	General Electric carrier, wireless	38
		Cu. sleeves	None		Siemens-Martin galv.	4/6	1	None	General Electric carrier, wireless	39
		Cu. sleeves	None		Siemens-Martin galv.	3/6	1	None	None	40
No. 4/0	Twist sleeves	Oxide film	G. E.		5-mi. Cu.-weld, bal.h.s.	3/6	1	None	Carrier	41
No. 1/0	Twist sleeves	Oxide film	G. E.		Copper-clad steel	5/10		None	Private line	42
4/0	Twist sleeves	Oxide film	G. E.		Copper-clad steel	3/6	1	None	Leased line	43
4/0	Twist sleeves	Oxide film	G. E.		Str. high strength galv.	3/6	1	None	Private, separate poles	44
1/0	Twist sleeves	Oxide film	G. E.		S.-M. galv. steel	3/6	1	None	Private, separate poles	45
No. 4/0	Twist sleeves	Oxide film	G. E.		No ground wire			None	Leased wire	46
1/0	Twist sleeves	Oxide film	G. E.		Galv. S.-M. stranded	3/6	1	Copperweld rod every pole	Leased line	47
1/0	Twist sleeves	Oxide film	G. E.		None			None	Private line	48
	Seamless Cu. sleeves	Aluminum cell	G. E.		None			3/4" galvanized guy strand	Private telephone	49
		Oxide film; a. v.			Steel		1		Telephone	50
		Electrolytic			Steel	3/6	2		Public telephone	51
		Electrolytic			Steel	7/10	2		Public telephone	52
		Oxide film			Steel	4/10	2		Public telephone	53
		Oxide film; a. v			Steel	7/10	2		Public telephone	54
	Compression joint	None			Copperweld	9/10	1	Grillage	Leased circuits	55
	Served and soldered	None			Copperweld	2 1/32	2	4-250,000 c.m. Cu. driven with piles in salt meadow; steel grillage in upland	Leased circuits	56
	Compression joint	None			Copperweld	2 1/32	2		Leased circuits	57
	Compression joint	None			Copperweld	2 1/32	2	Grillage and buried condr.	Leased circuits	58
	Compression joint	None			Copperweld	2 1/32	2	Grillage and buried condr.	Leased circuits	59
	Compression joint	None			Copperweld	2 1/32	2	Grillage and buried condr.	Leased circuits	60
16"	Compression	None			A.C.S.R. (62%)	190,800 c.m.	2	Grillage	Leased circuits	61
		None			A.C.S.R. (70%)	203,000 c.m.	2	Grillage	Leased circuit	62
	Aluminum twist sleeve joint	None			None			Steel towers, earth footings	Bell	63
	Twist sleeve joint	None			None			Steel towers, earth footings	Bell	64
	Sleeves	Oxide film form B. O.	G. E.						Private telephone	65
	Sleeves	Oxide film form B. O.	G. E.		None				None	66
	Sleeves	Oxide film form B. O.	G. E.		Copperweld	3/6	1	Ground rod	Private telephone (metallic)	67
	Sleeves	S. v.	W'hse		None				Private telephone (metallic)	68
	Sleeves	Oxide film form B. O.	G. E.		None				None	69
	Sleeves	Oxide film form B. O.	G. E.		None				None	70
	Sleeves	Oxide film form B. O.	G. E.						Metallic circuit	71
o. 11,541	Twist sleeves	At Spring Grove, oxide film			Copperweld	3/6	1	No. 4 Cu-weld to Cu-weld rod	Bell	72
o. 11,541	Twist sleeves	At Spring Grove, oxide film			None			No. 4 Cu-weld to Cu-weld rod	Bell	73
	Twist sleeves	At Hanover, oxide film			None			No. 4 galv. iron down each pole	Bell	74
	Twist sleeves	At York term, oxide film			None			Steel towers	Bell	75
	Twist sleeves	None			None			No. 4 galv. iron down each pole	Bell	76
	Twist sleeves	I—on cust. equip., oxide film			None			No. 4 galv. iron down pole to coil under butt		77
	Aluminum twist sleeves	None			None			No. 4 galv. iron down pole to coil under butt	Bell leased lines	78
	Compression joint	None			None			Steel towers, earth footings	Bell	79
	Anaconda drawn sleeve				Copperweld steel	9/10	2	No special ground used	Bell	80
ngle	Anaconda drawn sleeve				Copperweld	9/10	2	No special ground used	Bell	81
	Aluminum compression joint				A.C.S.R.	183,600 c.m.	2	No special ground used	Bell	82
gle	Aluminum compression joint				A.C.S.R.	183,600 c.m.	2	No special ground used	Bell	83
	Aluminum compression joint				A.C.S.R.	183,600 c.m.	2	No special ground used	Bell	84
1,542	Aluminum compression joint				A.C.S.R.	190,800 c.m.	1; 5 mi. 2	No special ground used	Bell	85
	Twist sleeves				7 str. Cu.-oov'd steel	7/16	2	No special ground used	Bell	86
	Aluminum compression joint				A.C.S.R.	190,800 c.m.	1	No special ground used	Bell	87
20½"	Cold pressed aluminum	At sub., oxide film	G. E.		A.C.S.R.	397,500 c.m.	1	Gr. wire connected to tower	Bell, leased line	88
	Sleeves	At sub.			None			None except switches	None	89
287,549	Sleeves	None	None		None			None	Bell	90
,541	Sleeves	None	None		None			None	Bell; Johnstown metallic private	91
1,541	Sleeves	None	None		None			None	Bell; private metallic	92
1,541	Sleeves	None	None		None			None	Bell; Johnstown carrier	93
,541	Sleeves	None	None		None			None	Bell, carrier	94
440,607	Sleeves	None	None		None			None	Bell; private metallic	95
440,607	Sleeves	None	None		None			None	Bell; carrier current	96
440,607	Sleeves	None	None		None			None	Bell; Johnstown carrier	97
541	Sleeves	None	None		None			None	Bell	98
	Sleeves	At terminals			Copperweld	3/6	2		Telephone circ. on separate pole lines	99
	Sleeves	None			Copperweld	4/10	1		Telephone circ. on separate pole lines	100
	Cu. sleeves	None			Galvanized steel	3/6	2	Steel ground rod	No. 2 extra high-tension cu.-weld	101
	Cu. sleeves	None			Copperweld	3/6	2	Steel ground rods at t'wrs with conc. anchors	No. 4 extra high-tension cu.-weld	102
645	Cu. sleeves	None			Copperweld	3/6	2	Steel ground rods at t'wrs with conc. anchors	No. 4 extra high-tension cu.-weld	103
	Cu. sleeves	None			Copperweld	3/6	2	Steel ground rods at t'wrs with conc. anchors	No. 4 extra high-tension cu.-weld	104
	Cu. sleeves	None			Copperweld	3/6	2	Steel ground rods at t'wrs with conc. anchors	No. 4 extra high-tension cu.-weld	105
	Cu. sleeves	None			On wood, none	3/6	P.—galv. s'l str. 2 (s'l)	Earth anchors ground t'wrs	None	106
	Cu. sleeves	None			Special mixed str's	3/6	2	(See line 101)	None	107
	Cu. sleeves	None			Copperweld	3/6	2	(See line 101)	No. 2 extra high-tension cu.-weld	108
	Cu. sleeves	None			Copperweld	3/6	2	Steel ground rod	No. 2 extra high-tension cu.-weld	109
545;	Cu. sleeves	None			None			Galvanized steel strand	None	110
	Cu. sleeves	None			None			Galvanized steel strand	None	111
No. 704	Twist sleeves	At sub., oxide film	G. E.		High strength steel	3/6	1	3/4" pipe 6' long at poles	Western Electric carrier and Bell Telephone	1
No. 704	Twist sleeves	At sub., oxide film	G. E.		(2)	3/6	1	None	Western Electric carrier and Bell Telephone	2
No. 704	Twist sleeves	At sub., oxide film	G. E.		High strength steel	3/4	1	3/4" pipe 6' long at poles	Western Electric carrier and Bell Telephone	3
	2-pc. aluminum compr. joint w/ McIntyre on steel core	None			A.C.S.R.(4)	134,800 c.m.	1	Earth footings	Carrier current	4
		None			A.C.S.R.(4)	134,800 c.m.	1	Earth footings	Carrier current	5
		None			A.C.S.R.(4)	134,800 c.m.	1	Earth footings	Carrier current	6
	Compression joint, sleeve and core	None			A.C.S.R.	134,800 c.m.	1	Earth footings	Carrier current	7
	2-pc. compr.; McIntyre on core	None			A.C.S.R.(4)	134,800 c.m.	1	Earth footings	Carrier current	8
	Compression joint, sleeve and core	None			A.C.S.R.(4)	134,800 c.m.	1	Earth footings	Carrier current	9
"	Sleeves	Electrolytic	G. E.		Iron	9	2	Ground rods	2-wire telephone	9a
	Cu. McIntyre	None			A.C.S.R; C-wld.	Cu.-Weld 3/6	1	38.6 miles, ground rod	Carrier current	10
	2-pc. aluminum compr. j't. w/ McIntyre on steel core	None			A.C.S.R.(4)	134,800 c.m.	1	Earth footings	Carrier current	11
		None			A.C.S.R.(4)	134,000 c.m.	1	Earth footings	Carrier current	12
	Sleeve joint							No. 6 iron	Telephone on part	13
	Sleeves	1 A-v.; 1 (bus) oxide film	G. E.		Copper	3/6	1	Suspension clamp	Leased line	14
	Sleeves	2 oxide film at terminals			Copper	3/6	1	Suspension clamp	Leased line	15
	Sleeves	Oxide film; a-v.			Copperweld	3/4	1	Suspension clamp	Leased wire	16
	Compression joint	Oxide film (at one end)	G. E		Copperweld	7/10	1	Suspension clamp	Bell City telephone	17
	Sleeves	Oxide film	G. E.		Copperweld	1/2	1	Through clamp to tower	Leased line	18
	Compression joint	Oxide film			Copperweld	7/10	1	Suspension clamp	Leased wire	19
	Sleeves	Oxide film	G. E.		Copperweld	1/2	1	Suspension clamp	Radio and leased wire	20
	Sleeves	Oxide film	G. E.		Copperweld	1/2	1	Suspension clamp	Radio and leased lines	21
	Sleeves	Oxide film	G. E.		Copperweld	1/2	1	Suspension clamp	Leased line	22
	Sleeves	Oxide film	G. E.		Copperweld	1/2	1	Suspension clamp	Leased wire	23
	Aluminum double sleeve joint					..	..	No. 6 iron	Telephone on part	24
	Lock splice	Oxide film	G. E.		Galvanized steel	3/6	2	None	None	25
	McIntyre sleeves	Oxide film	G. E.		Galvanized steel	3/6	2	Driven pipe	None	26
	McIntyre sleeves	Oxide film	G. E.		Galvanized steel	3/6	1	None	None	27
	McIntyre sleeves	Oxide film	G. E.		Galvanized steel	3/6	1	None	None	28
	McIntyre sleeves	Oxide film	G. E.		Copperweld steel	3/4	1	None	Carrier current	29
	McIntyre sleeves	Oxide film	G. E.		None			Bayonet with ground wire	Telephone	30
No. 704	Twist sleeves	Oxide film	G. E.		High strength steel	3/6	1	No. 2 wire coiled at pole base	Western Electric carrier and Bell telephone	31
704	Twist sleeves	Oxide film	G. E.		High strength steel	3/6	1	No. 2 wire coiled; 6' pipe	Western Electric carrier and Bell telephone	32
	Twist sleeves	Oxide film	G. E.		High strength steel	3/6	1	No. 2 wire coiled; 6' pipe	Western Electric carrier and Bell telephone	33
	Twist sleeves	Oxide film	G. E.		High strength steel	3/6	1		Western Electric carrier and Bell telephone	34
	Twist sleeves	Oxide film	G. E.		High strength steel	3/6	1	Malone anchors		35
	Aluminum 2-pc. compression	Oxide	G. E.		Copperweld, high str.	1/2	2	Earth footings	Carrier current	36
	Twist sleeves	Oxide film	G. E.		High strength steel	3/6	1	Copper wire coiled at base of pole	Bell telephone	37
No. 704;	Twist sleeves	Oxide film	G. E.		High strength steel	3/6	1	No. 2 wire coiled at base of pole	Western Electric carrier and Bell PBX	38
No. 704	Twist sleeves	Oxide film	G. E.		High strength steel	3/6	1	No. 2 wire coiled at base of pole	Western Electric carrier and Bell PBX	39
	Twist sleeves	Oxide film	G. E.		High strength steel	3/6	1	None	Bell telephone PBX	40
	Twist sleeves	Oxide film	G. E.		High strength steel	3/6	1	None	Bell telephone PBX	41
	Aluminum 2-pc. compression	Autovalve, oxide film	W'se, G. E.		A.C.S.R.	159,000 c.m.	2	Earth footing	Bell telephone, leased line	42
	Twist sleeves		G. E.		Copperweld strand	5/16	1	Driven iron pipe	Westinghouse carrier current	43
	Twist sleeves		G. E.		None				Westinghouse carrier current	44
	Twist sleeves		G. E.		Cu.-weld str., twrs only	5/16	1	Driven iron pipe	Westinghouse carrier current	45
	Twist sleeves	One each end of each circuit;	G. E.		S.-M. steel str.	7/16	1	Clamp to tower	Local exchange	46
	Compression sleeves	oxide film	G. E.		A.C.S.R.	159,000 c.m.	2	Bond to tower	General Electric carrier current	47
	Twist sleeves		G. E.		S.-M. steel str.	7/16	1	Clamp to tower	Westinghouse carrier current	48
	Compression sleeves		G. E.		Cu.-weld, ex-hi-ten str.	1/2	Each cct. 1	Bound to tower	Westinghouse carrier current	49
	Twist sleeves		G. E.		S.-M. steel str.	7/16	1	Clamp to tower	Westinghouse carrier current	50
	Twist sleeves	3 oxide film	G. E.						Westinghouse carrier current	51
	(14)	(14)	(14)		(14)	(14)	(14)	(14)	(14)	52
	Twist joints								Carrier current	
	Twist joints									
	Twist joints				Aluminum	80,000 c.m.	1	9/128 copperweld rod		53
	Twist joints								General Electric carrier current	54
	Twist joints									57
	Twist joints								Carrier current	58
										59
	Twist sleeves	1 oxide film; 1 s. v.	G. E.; W'se		Copperweld strand	5/16	1	Driven iron pipe	Westinghouse carrier current	60
	Twist sleeves	3 oxide film	G. E.						Westinghouse carrier current	61
	Twist sleeves	1 oxide film; 2 s. v.	G. E., W'se		Copperweld strand	5/16	1	Driven iron pipe	Westinghouse carrier current	62
	Twist sleeves	Oxide film (each end)	G. E.						Westinghouse carrier current	63
	Twist sleeves	3 oxide film	G. E.		Copperweld strand	5/16	1	Driven iron pipe	Westinghouse carrier current	64
	Twist sleeves	Oxide film (each end)	G. E.						Westinghouse carrier current	65
	Hydraulic compression	Oxide film	G. E.		Galvanized steel str.	1/2	1(25)	No. 2 cu. at diagonal corners of tower	Carrier current and telephone	66
	Cu. sleeves twisted 4 times	Oxide film	G. E.		Galvanized steel str.	1/2	1(25)	No. 2 cu. at diagonal corners of tower	Carrier current and telephone	67
	Hydraulic compression	Oxide film	G. E.		Galvanized steel str.	1/2	1(25)	No. 2 cu. at diagonal corners of tower	Carrier current and telephone	68
	Twist sleeves	Oxide film	G. E.						Westinghouse carrier current	69
	Twist sleeves	Oxide film	G. E.						Westinghouse carrier current	70
	Twist sleeves	Oxide film	G. E.						Westinghouse carrier current	71
	Twist sleeves	Oxide film	G. E.						Westinghousecarrier current	72
	Twist sleeves	Oxide film	G. E.						Westinghouse carrier current	73
	Twist sleeves	Oxide film	G. E.						Westinghouse carrier current	74
1,328	Twist sleeves	Oxide film	G. E.		Siemens-Martin steel	3/6	1	No. 2 cu. spiralled on butt of pole	Wire	75
1,328	Twist sleeves	Oxide film	G. E.		Siemens-Martin steel	3/6	1	No. 2 cu. spiralled on butt of pole	Wire	76
,231	Compression joint	Oxide film	G. E.		Siemens-Martin steel	3/6	1	Anchors grounded	Wire	77
76,231	Twist sleeves	Oxide film	G. E.		Siemens-Martin steel	3/6	1	Anchors grounded	Wire	78
0	Compressed joint	Oxide film	G. E.		Siemens-Martin steel	1/2	1	Anchors grounded	Wire	79
0 306	Twist sleeves	Oxide film	G. E.; El. Pr. Eq.		A.C.S.R.	3/6	1 and 2(18)	Iron pipe—2 per tower	Carrier current	80
	Sleeve compression	Oxide film	G. E.		A.C.S.R.	No. 3/6	1	Sherardized rod	Bell telephone	81
34"	Sleeve compression	Oxide film	G. E.		Red brass	7/10	2	Sherardized rod	Bell telephone	82
	Sleeve compression	Aluminum	G. E.		Copperweld	No. 1/4	1	Cables and rods	Private telephone	83
73,309	Sleeve compression	Oxide film	G. E.		A.C.S.R.	No. 3/6	1	Sherardized rod	Bell telephone	84

17	Poland—Struther (Y67)	1926		66	60	Steel towers	2	2.4
18	Salt Springs—Boardman (Z75)	1928		132	60	Steel towers	1	9.3
19	Sharon—Greenville (Y83)	1926		66(9)	60	Steel towers	1	14.4
20	Toronto—Boardman (Z-73)	1925		132	60	Steel towers	2	40.0
21	Toronto—Boardman (Z-74)	1925		132	60	Steel towers	2	40.0
22	Toronto—Lowellville (Z-72)	1928		132	60	Steel towers	2 (7)	46.8
23	Toronto—New Castle (Z-71)	1928		132	60	Steel towers	2 (7)	49.7
	Southern Ohio Electric Co.							
24	Pomeroy—Superior—Circleville	1922 to 1926	66,000	66	60	Wood poles	1	156.0
	Toledo Edison Co.							
25	Acme Station—Fitch	1922	50,000	66	60	Steel towers	2	11.0
26	Acme Station—Walbridge	1924	50,000	69	60	Steel towers	4	5.0
27	Fitch—Walbridge	1924	50,000	69	60	Steel towers	2	15.0
28	Toledo, Ohio—Michigan State line	1927	50,000	69	60	Steel towers	1	10.0
29	Toledo—point 15 miles east of Toledo	1928	100,000	132	60	Steel towers	1	15.0
30	Walbridge—Pemberville	1923	50,000	69	60	Wood poles	1	13.0
	Union Gas & Electric Co.							
31	Cincinnati (Hartwell)—Dayton	1923	12,500	66	60	Wood poles	1	13.4
32	Cincinnati (Hartwell)—Dayton. East line Hartwell—Carlisle except section shown for line 31	1923	12,500	66	60	Wood poles	1	38
33	Cincinnati (Hartwell) Dayton. West line section Hartwell—Hamilton—Trenton—Carlisle Junction		12,500	66	60	Wood poles	1	40
34	Columbia—Hartwell	1925	60,000	66	60	Steel towers	2	20
35	Columbia—Hartwell	1925	60,000	66	60	Steel towers	2	20
36	Columbia Power Station to Indiana State Line	1927	50,000, 100,000	132	60	Steel towers	2	0.7
37	Hamilton Contreas (8)	1924	7,500	66	60	Wood poles	1	21
38	Hartwell—Elmwood	1923	25,000	66	60	Wood poles	1	2.5
39	Hartwell—Elmwood	1923	25,000	66	60	Wood poles	1	2.5
40	Hartwell—Mitchell Avenue	1925	60,000	66	60	Steel towers	2	3.8
41	Oakley—Hartwell	1925	60,000	66	60	Steel towers	2	6
42	Trenton—Middletown	1928	24,000	66	60	Steel towers	2	3.4
	Indiana Electric Corp.							
43	Dresser (Terre Haute)—Clinton "A" Route	1925	6,000	66	60	Both (10)	1	21.2
44	Dresser (Terre Haute)—Clinton "B" Route	1927	6,000	66	60	Wood poles	1	24.36
45	Dresser (Terre Haute)—Sullivan	1925	6,000	66	60	Wood poles	1	24.73
46	Dresser—Water Street Plants (Terre Haute)	1925	6,000	66	60	Both	2	7.34
47	Kokomo—Howard—Brant County line connection to Indiana General Service Co.	1928	30,000	132	60	Steel towers	2	17 to Co. line
48	Lenore (Indianapolis)—Columbia (Cincinnati) (11)	1928	30,000	132	60	Steel towers	2	8.1
49	Lenore (Indianapolis)—Columbia (Cincinnati) (12)	1928	30,000	132	60	Steel towers	2 (13), 1	76.74
50	Lenore (Indianapolis)—Dresser (Terre Haute)	1924	30,000	132	60	Steel towers	2	73.86
51	Lenore (Indianapolis)—Knightstown	1924	6,000	66	60	Wood poles	1	41.31
52	Lenore (Indianapolis)—Shelbyville (14)	1928	6,000	66	60	(14)	(14)	26.4
	Interstate Public Service Co.							
53	Bedford—Edwardsport	1925	15,000	66	60	Steel towers	2	42.4
54	Connersville—New Castle	1926	6,000	66	60	Wood poles	1	28.2
55	Connersville—Ohio State Line	1924	6,000	66	60	Wood poles	1	20.4
56	Jeffersonville—Scottsburg	1925	5,000	66	60	Steel towers	1	29.7
57	Knightstown—New Castle	1925	10,000	66	60	Wood poles	1	14.9
58	New Castle—Henry County Line	1928		66	60	Wood poles	1	15.8
59	Scottsburg—Bedford	1924	5,000	66	60	Wood poles	1	42.6
	Northern Indiana Power Co.							
60	Converse—Indiana General Service Connection	1928	4,000	66	60	Wood poles	1	5.6
61	Kokomo—La Fayette	1925	6,000	66	60	Wood poles	1	42.7
62	Kokomo—Wabash	1928	6,000	66	60	Wood poles	1	36.63
63	Lenore (Indianapolis)—Noblesville	1925	6,000	66	60	Wood poles	1	34.08
64	Noblesville—Kokomo	1925	6,000	66	60	Wood poles	1	39.26
65	Noblesville to Madison—Henry County Line	1928	6,000	66	60	Wood poles	1	30.8
	Northern Indiana Public Service Co.							
66	Aetna—Michigan City	1926	50,000	132	60	Steel towers	1 (15)	23.0
67	Indiana—Illinois State Line to Aetna	1924 and 1925	50,000	132	60	Steel towers	1 (15)	13.8
68	Michigan City—New Carlisle	1926	50,000	132	60	Steel towers	1 (15)	22.75
	Wabash Valley Electric Co.							
69	Attica Loop	1925	6,000	66	60	Wood poles	2	6.11
70	Attica Loop Junction—La Fayette	1925	6,000	66	60	Wood poles	1	18.89
71	Clinton—Covington Double Circuit Junction	1925	6,000	66	60	Wood poles	1	35.94
72	Covington—Attica Loop Junction	1925	6,000	66	60	Wood poles	1	27.60
73	Covington Double Circuit Junction—State Line	1927	6,000	66	60	Wood poles	1	6.45
74	Double Circuit Junction—Covington	1923 and 1927 (16)	6,000	66	60	Wood poles	2	2.93
	Central Illinois Public Service Co.							
75	Grand Tower—Mound City	1928	10,000	66	60	Wood poles	1	57.01
76	Muddy—Effingham	1926	10,000	66	60	Wood poles	1	122.92
77	Muddy—Shawneetown	1924	20,000	66	60	Steel towers	2	27.18
78	Muddy—West Frankfort	1922	20,000	66	60	Steel towers	2	24.75
79	West Frankfort—Grand Tower	1923	50,000	66	60	Steel towers	2	35.69
	Commonwealth Edison Co.							
80	Calumet Station—108th St., Chicago—Chicago Heights—108th St., Chicago, Ill.—Aetna, Ind. (17)	1925		132	60	Steel towers	2	3.8
	East St. Louis Light & Power Co.							
81	Cahokia—Centerville—(Belleville)	1927	30,000	66	60	Steel towers	2	5
82	Cahokia—Venice	1927	50,000	66	60	Steel towers	2	4.8
83	Lake Avenue Substation—Alton	1915	12,000	66	25	Steel towers	1	24
84	Venice—Alton	1927	24,000	66	60	Steel towers	2	16.56
	[illegible]							
85	Peoria—Springfield	1923	30,000	[illegible]	60	Steel towers	1 (15)	93
	Illinois Northern Utilities Co.							
86	Belvidere, Ill.—Beloit, Wis	1927	10,000	66(20)	60	Wood poles	1	20
87	Belvidere—Crystal Lake	1929	50,000	132	60	Steel towers	1 (19)	22
88	Dixon—Belvidere	1928	50,000	132	60	Wood poles	1	52
	Illinois Power & Light Corp.							
89(a)	Belleville—Cahokia Power Plant	1927	15,000	66	60	Steel towers	2	12.6 (21)
89(b)	Edwardsville—Staunton	1929	5,000	66	60	Steel towers	2	21.6
89(c)	Kewanee—Seneca	1928		132	60	Steel towers	1	68
89(d)	Venice Plant—Edwardsville	1923	25,000	66	60	Steel towers	2	16
	People's Power Co.							
90	Fourth Street Station, Moline, Ill.—Riverside Station, 7½ miles East of Davenport, Iowa	1925	30,000	66	60	Steel towers	2	5.33
	Public Service Co. of Northern Illinois							
91	No. 5334: Bellwood substation No. 94 to Chicago City Limits	1928	60,000	66	60	Both	1 (23)	1.97 T., 1.37 P
92	No. 6581: Chicago Heights, D. C. No. 93 to Chicago City Limits	1925	22,800	132	60	Steel towers	2 (24)	10.611
93	No. 6582: Chicago Heights, D. C. No. 93 to Chicago City Limits	1925	34,300	132	60	Steel towers	2 (24)	13.12
94	No. 1901: Joliet Station No. 9—Chicago Heights, D. C. No. 93	1925	68,500	132	60	Steel towers	1 (23)	29.744
95	No. 1903: Joliet Station No. 9—Seneca	1928	34,300	132	60	Steel towers	1 (23)	36.85
96	No. 1601: Waukegan Station No. 6—Chicago City Limits	1924 and 1927 (25)	68,500	132	60	Steel towers	2 (27)	31.13
97	No. 1602: Waukegan Station No. 6—Evanston Substation No. 88	1927	30,000	132	60	Steel towers	2 (27)	27.47
98	No. 1607: Waukegan Station No. 6—Electric Junction Substation No. 111	1928	60,000	132	60	Steel towers	1 (23)	61.76
99	No. 1603: Waukegan Station No. 6—Wisconsin—Illinois State Line	1927	68,500	132	60	Steel towers	1 (23)	11.45
	Union Electric Light & Power Co. of Illinois							
100	Cahokia—Crystal City	1925	40,000	110	60	Steel towers	2	30.8
	Consumers Power Co.							
101	Argenta—Battle Creek	1920		140	30	Steel towers	2	26.1
102	Battle Creek—Jackson			140	60	Steel towers	1	44.30
103	Croton Dam—Grand Rapids	1907		75	30	Steel towers	1	42.75
104	Croton—Muskegon—Newaygo Spur			75	30	Steel towers	1	38.3
105	Edenville—Saginaw River	1924		140	60	Steel towers	1	39.70
106	Flint—Battle Creek	1912		140	60	Steel towers	1	112.30
107	Flint—Saginaw River	1925		140	60	Steel towers	2	45.8
108	Foote Spur	1917		140	60	Steel towers	1	4.6
109	Grand Rapids—Kalamazoo	1916		140	30	Steel towers	2	48.2
110	Grand Rapids—Muskegon	1928		140	30	Steel towers	1	39
111	Haslett—Millette (Belt Line)	1928		140	60	Steel towers	2	20
112	Hodenpyl Dam—Junction Dam	1924		140	30	Steel towers	1	10.5
113	Jackson—Cement City	1928		140	60	Steel towers	1	17.23
114	Jackson—Lansing	1928		140	60	Steel towers	1	37.843
115	Junction Dam—Grand Rapids	1918		140	30	Steel towers	2	101.12
116	Kalamazoo Battle Creek	1926		140	60	Steel towers	1	33.33
117	Kent City—Muskegon	1907		75	30	Wood poles	1	25.30
118	Loud—Cooke—Saginaw River	1912		140	60	Steel towers	1	94.38
119	Loud—Emery Junction	1917		140	60	Steel towers	1	18.5
120	Mio—Loud	1916		140	60	Steel towers	1	30.5
121	Newaygo—Fremont			75	30	Wood poles	1	9.3
122	Rogers Dam—Grand Rapids			75	30	Wood poles	1	53.8
123	Saginaw River—Flint (old)	1912		140	60	Steel towers	1	37.93
	The Detroit Edison Co.							
124	Brownstown—Monroe	1925	50,000 (29)	120	60	Steel towers	2	16.1
125	Brownstown—Navarre	1924	50,000 (29)	120	60	Steel towers	2	14.0
126	Brownstown—Superior	1924	50,000(29)	120	60	Steel towers	2	25.8
127	Bloomfield—Shelby	1923	50,000 (29)	120	60	Steel towers	2	13.3
128	Maryeville—Northeast	1928	50,000 (29)	120	60	Steel towers	1	55.5
129	Shelby—Maryeville	1923	50,000 (29)	120	60	Steel towers	2	38.1
130	Shelby—Northeast	1926	50,000 (29)	120	60	Steel towers	2	18.1
131	Superior—Blackstone (Interconnection)	1928	50,000 (29)	132	60	Steel towers	1	64
132	Superior—Bloomfield	1924	50,000 (29)	120	60	Steel towers	2	35.5
133	Trenton Channel—Brownstown	1924	50,000 (29)	120	60	Steel towers	2	3.6
134	Trenton Channel—Navarre	1926	50,000 (29)	120	60	Steel towers	2	17.4
135	Trenton Channel—Warren	1925	50,000 (29)	120	60	Steel towers	2	18.9
136	Trenton Channel—Warren	(31)	50,000 (29)	120	60	Steel towers	2	17.3
	Lake Superior District Power Co.							
137	Ashland—Ironwood	1922	12,000	66	60	Wood poles	1	43.3
138	Ironwood—Big Falls	1922	10,000	88	60	Steel towers	1	86.76
	Northern States Power Co. of Wisconsin							
139	Alma Center—Blair	1919—1920		69	60	Wood poles	1 (33)	23.82
140	Alma Center—Sparta	1921		69	60	Wood poles	1	44.1
141	Cashton Junction—Cashton	1920		69	60	Wood poles	1 (33)	1.5
142	Cedar Falls—Dells	1909—1928 (35)		69	60	Wood poles	1	23.35
143	Cedar Falls—Menomonie	1914—1927 (35)		69	60	Wood poles	1	4.4
144	Chippewa Falls to Junction with Wisacta—Eau Claire	1928		69	60	Wood poles	1 (36)	.225
145	Chippewa Falls Hydro—Wisota	1928		120	60	Steel towers	1	2.86
146	Chippewa Falls Hydro—Wissota to Eau Claire Line	1928		69	60	Wood poles	1	.241
147	Cotton School—Humbird	1919—1920		69	60	Wood poles	1	6.07
148	Eau Claire—Mondovi—Wabasha	1917		69	60	Wood poles (37)	1	44.91
149	First Crossing—Cotton School—Neillsville	1915		69	60	Wood poles	1	51.92
150	First Crossing—Dells Substation No. 2 Line	1912—1928 (35)		69	60	Wood poles	1	2.12
151	First Crossing—No. 1 Line Madison Street Eau Claire	1919		69	60		1	3
152	Herbert—Prescott	1914		69	60	Wood poles	1	22.7
153	Humbird—Alma Center	1919—1920		69	60	Wood poles	1 (33)	7.4
154	Jim Falls—Wisacta	1923		120	60	Steel towers	2	9.91
155	Lake City—Red Wing—Wabasha Line	1914		69	60	Steel towers	1	.93
156	La Crosse—Junction with Sparta—Viroqua Line	1920		69	60	Wood poles	1	24.33 (38)
157	Madison Street Substation, Eau Claire—Dells	1912		69	60	Steel towers	2 (39)	.88
158	Menomonie—Red Wing	1912		69	60	376 S.T.; 40 W.P.	1	37.8
159	Nelson—Cochrane	1917		69	60	Wood poles	1	15.3
160	Red Wing—Wabasha	1913		69	60	294 S.T.; 16 W.P.	1	30.36 (40)
161	Sparta—Viroqua	1920		69	60	Wood poles	(41)	31.6
162	T Corners—Neillsville	1927		69	60	Wood poles	1	36.5 (42)
163	Thorp Junction—T Corners	1920		69	60	Wood poles	(42)	27.55
164	Thorp Junction—Thorp	1918		69	60	Wood poles	1	1
165	Westby Junction—Westby	1920		69	60	Wood poles	1	1.5
166	Wissota—First Crossing No. 1	1923		69	60	Wood poles		10.4
167	Wissota—First Crossing No. 2	1912		69	60	Wood poles	1	10.4
168	Wissota—South St. Paul	1924		120	60	10 S.T.; 750 W.P.	1	77.30
169	Wissota—Stillwater	1916		120	60	Steel towers	1	75.5
170	Wissota—Thorp Junction	1918		69	60	Wood poles	1	28.83
	Wisconsin Power & Light Co.							
171	Dane—Fond du Lac	1922						
172	Fond du Lac—Ripon	1927	4,000	66	60	Wood poles	1	86.8
173	Fond du Lac—Sheboygan	1921	4,000	66	60	Wood poles	1	22.6
174	Janesville—Beloit	1925	4,000	66	60	Wood poles	1	41.6
175	Kilbourn—Watertown	1908	5,000	66	60	Wood poles	1	14.5
176	Madison—Janesville	1920	20,000	66	25	Steel towers	2	67.4
177	Prairie du Sac—Madison	1915	10,000	66	60	Steel towers	2	42.5
178	Prairie du Sac—Portage	1914	16,000	66	60	Steel towers	2	26.7
			12,000	66	25	Steel towers	2	23.8
	Wisconsin Public Service Corp.							
179	Bayside Plant—Green Bay	1926 (44)	85,800	66	60	Steel towers	2	10.4
180	Brillion—Chilton	1920	21,000	66	60	Wood poles	1	14.5
181	Caldron Falls—High Falls, Plants	1923	77,000	66	60	Wood poles	1	6.65
182	Chilton—New Holstein	1921	41,000	66	60	Wood poles	1	7.38
183	Green Bay—Oshkosh	1925	9,700	66	60	Wood poles	1	33.1
184	Green Bay—Sawyer	1921	5,700	66	60	Wood poles	1	54.14
185	High Falls Plant—Bayside Plant	1910 (45)	16,400	66	60	Steel towers	2	59.64
186	Lake Shore Junction—Kewaunee	1921	6,500	66	60	Wood poles	1	4.74
187	Peshtigo Junction—Peshtigo	1923	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

7,000	9	A. B. C.	American Bridge	A.C.S.R.	266,800	144	27	60	500, 900
	11	A. B. C.	American Bridge	M.h.d. Cu.	300,000	156			450
14,000	6	A. B. C.	American Bridge	Al. A.C.S.R.	266,800	144—158	27	132	900
14,000	5	A. B. C.	American Bridge	Cu.	300,000	156, 168	27	132	1,000
14,000	5	A. B. C.	American Bridge	Cu.	300,000	156, 168	27	132	1,000
	5	A. B. C.	American Bridge	Cu.	300,000	156, 168			1,000
14,000	5	A. B. C.	American Bridge	Cu. M.H.D.	300,000	156, 168	27	132	1,000
	8	2 pole H, 3-pole angle, 4-pole special		A.C.S.R.	211,600	126	25	33	900
12,000	11	2-circuit	American Bridge	H.d. Cu.	250,000	90 and 96	30	30	500
54,900	8	6-circuit	American Bridge	H.d. Cu.	250,000	120	35	30	850
17,926	7	2-circuit	American Bridge	H.d. Cu.	250,000	102	35	30	850
9,125	7	2-circuit	American Bridge	M.h.d. stranded Cu.	211,600	96	25	50	750
8,075	8	2-circuit	American Bridge	M.h.d. stranded Cu.	211,600	44	25	64	700
	26			H.d. Cu.	211,600	72, 104 H	30	30	200
	18			Cu.	300,000	84—96—120	25	36	300
	18			A.C.S.R.	477,000	84—96—120	25	36	300
	18			A.C.S.R.	477,000	84—96—120	25	36	300
11,720; 20,330	4	Rigid square base	Blaw-Knox	Cu.	400,000	144	30	48	1,200
11,720; 20,330	4	Rigid square base	Blaw-Knox	Cu.	400,000	144	30	48	1,200
25,000; 30,000	8.6	Square base rigid	Riter-Conley	A.C.S.R.	397,500	156	30	40	786
	18			Cu.	No. 2/0	84x96x120	25	36	500
	25			A.C.S.R.	477,000	84x96x120	25	36	200
	25			A.C.S.R.	477,000	84x96x120	25	30	200
11,720; 20,330	4	Rigid square base	Blaw-Knox	Cu.	400,000	144	30	48	1,200
11,720; 20,330	4	Rigid square base	Blaw-Knox	Cu.	400,000	144	30	48	1,200
12,830; 20,920	6.18	Square base rigid	Blaw-Knox	A.C.S.R.	397,500	156	30	36	920
8,025 standard suspension	30	45 ft. W. R. C. and creosote pine		7 strand Cu.	133,225	83.88 equiv.	25	30	175
	27	45 foot W. R. C. poles		7 strand Cu.	133,225	83.88 equiv.	25	30	200
	30	45 foot W. R. C. poles		7 strand Cu.	133,225	83.88 equiv.	25	30	175
10,790	7 T., 30 P.	2 circuit angle	Blaw-Knox	A.C.S.R.	No. 4/0	201.64 T.; 83.16 P.	25	30	175 P.; 800 T.
line 13,600 standard suspension	5.2	2 circuit suspension	Riter-Conley	A.C.S.R.	397,500	156	25	38 (45° swing)	1,000
8,025 standard suspension	6.6	2 circuit suspension	Blaw-Knox	19 strand Cu.	211,600	132	25	35 (45° swing)	800
13,600 standard suspension	5.2	2 circuit suspension	Riter-Conley	A.C.S.R.	397,500	156	25	38 (45° swing)	1,000
8,025 standard suspension	6.6	2 circuit suspension	Blaw-Knox	19 strand Cu.	211,600	132	25	35 (45° swing)	800
	30	45 foot W. R. C. poles		7 strand Cu.	133,225	83.88 equiv.	25	30	175
(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)
2,740	10		Bates	A.C.S.R.	167,805	84	22	72	500
	17			A.C.S.R.	167,805	84	22	48	300
	15			A.C.S.R.	167,805	84	24	48	350
5,190	7	Double circuit	American Bridge	A.C.S.R.	167,805	96	22	72	750
	17			A.C.S.R.	167,805	84	22	48	200
	17			A.C.S.R.	211,600	84	23	48	300
	17			A.C.S.R.	167,805	84	22	42	300
	35	40 foot W. R. C. poles		7 strand Cu.	105,625	83.88 equiv.	22	30	150
	27	45 foot W. R. C. poles		7 strand Cu.	133,225	83.88 equiv.	25	30	200
	35	40 foot W. R. C. poles		7 strand Cu.	133,225	83.88 equiv.	22	30	150
	35	45 foot W. R. C. poles		7 strand Cu.	133,225	78.24 equiv.	25	30	150
	35	45 foot W. R. C. poles		7 strand Cu.	133,225	83.88 equiv.	25	30	150
	27	45 foot W. R. C. poles		7 strand Cu.	133,225	83.88 equiv.	25	30	200
16,000 Ave.	5.53	Suspension, strain, transposition	Riter-Conley	A.C.S.R. 30 and 7 strand	397,500	160	28	43	1,000
17,200 Ave.	5.53 Ave.	Suspension, strain, transposition	Riter-Conley	19 strand hard drawn Cu.	300,000	160	35	47	700, 1,000
16,500 Ave.	5.54	Suspension, strain, transposition	Riter-Conley	A.C.S.R. 30 and 7 strand	397,500	160	28	43	1,000
	30	45 foot W. R. C. poles		7 strand Cu.	133,225	83.16 equiv.	25	30	175
	27	45 foot W. R. C. poles		7 strand Cu.	133,225	83.88 equiv.	25	30	200
	30	45 foot W. R. C. poles		7 strand Cu.	133,225	83.88 equiv.	25	30	175
	30	45 foot W. R. C. poles		7 strand Cu.	133,225	83.88 equiv.	25	30	175
	21	50 foot W. R. C. poles		7 strand Cu.	133,225	107.16	25	36	250
	30	45 foot W. R. C. poles		7 strand Cu.	133,225	83.16 equiv.	25	30	175
	22			A.C.S.R.	No. 4/0	72 vert.; 120 horiz.	20	34	240
	22			A.C.S.R.	No. 4/0	72 vert.; 120 horiz.	20	34	240
3,550; 5,800; 6,350	7.5	Wide base 4 leg	Aermotor	A.C.S.R.	No. 3/0	84 v.; 158 and 228 h.	20	30	700
3,550; 5,800; 6,350	7.5	Wide base 4 leg	Aermotor	A.C.S.R.	No. 3/0	84 v.; 158 and 228 h.	20	30	700
4,350; 6,785; 8,175	7	Wide base 4 leg	Aermotor	A.C.S.R.	397,500	102 v.; 180 and 252 h.	20	40	750
8,780; 15,945; 17,635	6	Wide base	Riter-Conley	Cu.	300,000	156	25	48	880
5,000	7	Square	Water Bates Steel	A.C.S.R.	No. 4/0	96; 2' offset	24	28	750
8,000	6.25	Square	Riter-Conley	Cu.	350,000	96; 2' offset	50	32	800
5,000	13	A-frame	Riter-Conley	Cu.	No. 1/0	72	25	28	400
5,000	7	Square	Riter-Conley	A.C.S.R.	No. 3/0	96; 2' offset	24	28	660
4,350; 6,000	6	Wide base	Blaw-Knox	Cu.	No. 3/0	144	25	48	700
	12 H fixtures	2-50 foot poles with 29 foot X-arm		A.C.S.R.	266,800	168	26	60	450
	6			Cu.	300,000		25	100	880
	12 H fixtures	2-50 foot poles with 29 foot X-arm		A.C.S.R.	266,800	168	26	60	450
(21) 4,000; 6,000	9	4 leg self supporting 15 foot square base	Walter Bates Steel	A.C.S.R.	No. 3/0	204 and 240 h.; 96 v.	25	28	660
4,000; 6,000	9	4 leg self supporting 15 foot square base	Walter Bates Steel	A.C.S.R.	No. 3/0	204 and 240 h.; 84 v.	25	28	660
10,000	7	Suspension and strain	Riter-Conley	Aluminum	477,000	156	25	108	800
4,500; 7,000	9	Square base, 15 foot	American Bridge	A.C.S.R.	No. 3/0	168 and 204 h.; 84 v.	25	28	660
	7	Square base		A.C.S.R.	336,400	108	Varies	42	1,000
1.37 P 5,330; 7,160; 11,960	11 T, 2 P	Wide base	Blaw-Knox	Cu.	400,000	84	37	36	450 T.; 250 P.
1 Suspension 8,780;	6	Wide base	Riter-Conley	Cu.	300,000	156	25	48	880
Dead-e d 15,945;	6	Wide base	Riter-Conley	Cu.	300,000	156	25	48	880
4 90° cor. 17,635	6	Wide base	Riter-Conley	Cu.	300,000	156	25	48	880
8,705; 13,740; 17,465	6	Wide base	Riter-Conley	Cu.	300,000	156	25	48	880
6,125; 16,853	11	Wide base	Lt. Aermo.; h'vy, Kenwd Br.	Cu.	300,000	156	25	48	500
6,125; 16,853	11	Wide base	Lt. Aermo.; h'vy, Kenwd Br.	Cu.	300,000	156	25	48	500
8,730; 13,745; 16,195	6	Wide base	Riter-Conley	Cu.	300,000	156	25	48	880
9,040; 14,060; 17,680	6	Wide base	Riter-Conley	A.C.S.R.	477,000	156	25	48	880
6,000; 9,000	6.5	Square	Riter-Conley	A.C.S.R.	300,000	144, 42 offset	29	36	800
3,365	10.43	Rigid 4-post	Aermotor	Cu.	No. 2/0	144	25	48	520
1,940	10.19	Rigid 4-post	Aermotor	Cu.	No. 2/0	144	25	48	600
	11	Rigid 3-post	Aermotor	Cu.	72,670;	156, 96, 168	25	36	500
1,940	10.7	Rigid 3-post KK-71	Aermotor	Cu. h.c.	7 strands, No. 2/0	203, 144, 206	25	48	
4,700	8.7	Rigid 4-post	Aermotor	Cu.	No. 2/0	144	25	48	530
1,940	10.9	Ridid 3-post	Aermotor	Cu.	110,000 and 115,000	204,144,204	25	48	520
4,700	8.8	Rigid 4-post	Aermotor	Cu.	No. 3/0	144	25	48	530
1,940	9.9	Rigid 3-post	Aermotor	Cu.	110,000	204, 144, 206	25	48	520
3,365	10.02	Ridig 4-post	Aermotor	Cu. m.h.d.	110,000	144	25	48	520
4,625	7.5	Rigid 4-post	Aermotor	A.C.S.R.	No. 4/0	222	25	60	765
4,868	10	Rigid 4-post	Aermotor	A.C.S.R.	No. 4/0	144	25	60	660
	10	Rigid 4-post	Blaw-Knox	Cu.	No. 2/0	178.8	22	48	520
6,650	6	Rigid 4-post	Aermotor	Cu.	No. 4/0	200	25	60	900
3 3,400	8.3	Rigid 4-post	Aermotor	A.C.S.R.	No. 4/0	228.5, 144, 228.5	25	60	765
2,800	10.46	Rigid 4-post	Blaw-Knox	Cu.	110,000	144	25	48	520
2,840	10	Rigid 4-post	Aermotor	A.C.S.R.	No. 4/0	144	25	48	520
	48.6			Cu.	No. 2 solid	89, 62.5, 89	23	24	250
1,940	10.2	Rigid 3-post	Aermotor	Cu.	110,000—115,000	204, 144, 206	25	48	520
1,940	10.4	Rigid 4-post	Aermotor	Cu.	110,000	144	25	48	520
1,940	10	Rigid 3-post	Aermotor	Cu.	115,000	204, 144, 206	25	48	520
				Copperweld	No. 5	64, 64, 84	25		150
	48			Cu.	66,400	60	25		125
3 1,940	10	Rigid 3-post KK-71	Aermotor	Cu.	115,000	204, 144, 204	25	48	520
76,000; 12,500	7	Square base 15 feet; 18 feet	American Bridge	Cu.	167,772	120, 120—24 offset	28	42	880
7,600; 12,500 (30)	7—8	Square base 15 feet; 18 feet	American Bridge	Cu.	167,772	120, 120—24 offset	28	42	880
7,600; 12,500 (30)	7	Square base 15 feet; 18 feet	American Bridge	Cu.	167,772	120, 120—24 offset	28	42	880
7,600; 12,500 (30)	7	Square base 15 feet; 18 feet	American Bridge	Cu.	167,772	120, 120—24 offset	28	42	880
8,300; 14,300 (30)	7	Square base 17 feet; 18 feet	American Bridge	Cu.	167,772	144, 132—36 offset	28	48	880
7,600; 12,500 (30)	7	Square base 15 feet; 18 feet	American Bridge	Cu.	167,772	120, 120—24 offset	28	42	880
8,700; 16,500 (30)	7—8	Square base 17 feet; 18 feet	American Bridge	Cu.	167,772	144, 132—36 offset	28	48	880
7,600; 14,200 (30)	6	Square base 17 feet; 20 feet	American Bridge	Cu.	211,600	156, 144—30 offset	30	54	900
7,600; 12,500 (30)	7	Sqaure base 15 feet; 18 feet	American Bridge	Cu.	167,772	120, 120—24 offset	28	42	880
7,600; 12,500 (30)	7—8	Square base 15 feet; 18 feet	American Bridge	Cu.	250,000	120, 120—24 offset	28	42	880
7,600; 12,500 (30)	7—8	Square base 15 feet; 18 feet	American Bridge	Cu.	167,772	120, 120—24 offset	28	42	880
7,600; 12,500 (30)	7—8	Square base 15 feet; 18 feet	American Bridge	Cu.	167,772	120, 120—24 offset	28	42	880
7,725; 9,300 (30)	10—11	Square base 6 feet	American Bridge	Cu.	167,772	132, 120—30 offset	35	48	550
	18			No. 0 Cu., No. 2 aluminum	No. 0; No. 2	84	30	48	300
	9		Aermotor and Blaw-Knox	No. 0 aluminum	No. 0	108	45	72	600
	18.4			Stranded Cu.	No. 4	84, 79, 106	27	33	175
	20			Aluminum	No. 1/0	84, 61, 94	28	30	275
	27.1			Aluminum	No. 1/0	94, 84, 61	28	30	275
	17.6			Stranded Cu.	No. 1 (3 strand No. 6)	90, 73, 106	25	33	300
	19.1			Stranded Cu.	No. 1 (3 strand No. 6)	90, 73, 106	35	33	300
25				Copperweld	3/8"	162	50	49 1/16 susp;	
5 8,440	10	Tangent	Walter Bates Steel	Stranded Cu.	No. 2/0	160	26	68 5/16 dead end	500
41				Copperweld	3/8"	162	50		
7	24.9			Aluminum	No. 1/0	82, 67, 106	28	41	175
1	13.2			Stranded Cu.	No. 2	84, 73, 97 on △	24	36	400
2	20			Aluminum	No. 1/0	84, 94, 61	28	30	275
	17.6			Stranded Cu.	No. 1 (3 strand No. 6)	90, 73, 106	25	33	300
	24			Stranded Cu.	No. 2/0	84, 94, 61	30	30	220
	24.2			Stranded Cu.	No. 4	72, 72, 72	24.5	24	200
	44.9			Aluminum	No. 1/0	82, 67, 106	28	41	175
	8.7	Double circuit 50 foot Aermotor	Aermotor	Stranded Cu.	No. 2/0	174, 210, 174	40	63	550—600
Min. 1,670; max. 2,375	10	3 leg	Aermotor	Stranded Cu.	No. 2	108, 191, 191	41.5	66	500
(38)	27.1			Aluminum	No. 1/0	94, 84, 61	28	30	250—300
3 2,400	13	Truscon double circuit	Minneapolis Steel & Machine	3 No. 2 str. and 3 No. 2 solid	No. 2	102, 126, 102, 54	32 feet 6 in.	4.25	400
40 foot 1,150; 50 foot sp'l 2,800	11	3-post	Aermotor	Solid Cu.	No. 4	72, 62, 90	40	30	500
	18			Solid Cu.	No. 2	78, 78	30	39	300
(40) Min. 40 ft. 1,150; max. 100 ft. 7,10 0	10.2	3 leg	Aermotor	Stranded Cu.	No. 2	108, 191, 191	6 in.	66	500
	27.1			Aluminum	No. 1/0	94, 84, 61	28	30	275
(42)	18			Stranded Cu.	3 strand No. 6	114, 76, 115	39	33	300
	21.1			Aluminum	No. 1/0	84, 61, 94	28	30	250
	21.1			Stranded Cu.	No. 2	84, 61, 94	28	30	250
	27.1			Aluminum	No. 1/0	84, 61, 94	28	30	275
	18			Stranded Cu.	No. 4/0	110, 84, 72	29	42	300
	24			Stranded Cu.	No. 2/0	84, 61, 94	33	30	220
	9.8			Aluminum cable	No. 4/0	150, 150	33	72	600
	7.6		Aermotor	Stranded Cu.	No. 2/0	126, 173, 182	36	58	650
3	21.1			Stranded Cu.	No. 2	84, 61, 94	28	30	250
	20			Str. Cu. 50 mi. A.C.S.R. 36.8	Cu. 83,694, Al. 133,079	72	23	44	250
	20			A.C.S.R.	133,220	72	23	48	265
	20 for 25 100 for 17			Strand Cu.	66,358	60	23	36	250, 100
	8	Wood H-frame		A.C.S.R.	211,600	120	23	72	660
4,000; 6,000	10	4-leg	Aermotor	Str. Cu. hemp core	105,500	72	20	45.5	525
3,500; 4,200	8	4-cornered	Aermotor	A.C.S.R.	211,600	72	27	48	660
4,000; 7,000	11	4-cornered	American Bridge	Aluminum	133,220	78	27	48	660
4,000; 6,000	8	4-post	American Bridge	Stranded Cu.	105,500	72	20	48	650
	10	Rigid	Aermotor	7 str. h.d. Cu.	105,500 and 133,100 (4 mi.)	72	24		500
	28			A.C.S.R.	66,373	72		31	200
	14	Wood H-frame		7 str. h.d. Cu.	105,500	102	33	51	400
	28			A.C.S.R.	66,373	72		31	200
	15	Wood H-frame		7 str. m.h.d. Cu.	105,500	102	33	51	400
	28			A.C.S.R.	66,373	72	32	32	200
	10	Rigid	Aermotor	7 str. h.d. Cu.	105,500 and 133,100 (4 mi.)	72	24	32	500
	31			A.C.S.R.	66,373	72	32	32	200
	37						30	51	300

	27	60	300, 900			Vertical		5					
			450		6,000	△	132,000	10	Locke-Hewlett No. 9,140	Locke	11	Locke-Hewlett No. 9,140	
58	27	132	900		5,000	Vertical	66,000	5	Locke 8400	Locke	6	Locke No. 8,700	
68	27	132	1,000		6,000	Vertical	132,000	9	Locke-Hewlett No. 9,140	Locke	10	Locke-Hewlett No. 9,140	
68	27	132	1,000		6,000	Vertical	132,000	10	Ohio Brass No. 25,620	Ohio Brass	11	Ohio Brass No. 25,620	
68			1,000		6,000	} Vert. to T. 184;	132,000	10	Locke-Hewlett No. 9,140	Locke	11	Locke-Hewlett No. 9,140	
	27	132	1,000		6,000	} H. to end of line	132,000	10	Locke No. 9,140	Locke	11	Locke-Hewlett No. 9,140	
	25	33	900	27	1,080	Horizontal	66,000	5	10" suspension disc	Ohio Brass	6	10" suspension disc	
96	30	30	500	12	1,950	Vertical	69,000	5	Suspension	Ohio Brass	6	Suspension	
	35	30	850	35.35	1,950	Vertical	69,000	6	Suspension	Ohio Brass	6	Suspension	
	35	30	850	35.35	1,950	Vertical	69,000	5	Suspension	Ohio Brass	6	Suspension	
	25	50	750	25.2	1,700	Vertical	69,000	5	Suspension	Ohio Brass	6	Suspension	
	25	64	700	22.4	1,700	Vertical	132,000	9	Suspension	Jeffery-Dewitt	11	Suspension	Jef
H	30	30	200	2	1,700	△	69,000	5	Suspension	Ohio Brass	6	Suspension	
-120	25	36	300	3.95	2,640; 5,000 at B loading	△	66,000	5	Cap & pin susp. No. 25,620	Ohio Brass	6	Cap and pin susp. No. 26,240	
-120 }	25	36	300	4.25	1,325; 4,500 B	△	66,000	4, 5	J.-D. susp.; cap & pin susp.	J.-D.; O. B.	5, 6	Jeffery-Dewitt & O. B. susp.	J.
-120	25	36	300	4.25	1,325; 4,500 B	△	66,000	4, 5	J.-D. susp.; cap & pin susp.	J.-D.; O. B.	5, 6	J.-D. susp and cap & pin susp.	J.
	30	48	1,200	42.7	5,180; 9,400 B	Vertical	66,000	7(8)	Cap & pin susp. No. 25,620	Ohio Brass	7(8)	Cap and pin susp. No. 26,240	
	30	48	1,200	42.7	5,180; 9,400 B	Vertical	66,000	8	Cap & pin susp. No. 25,620	Ohio Brass	8	Cap and pin susp. No. 26,240	
	30	40	786	14.5	3,300	Vertical	132,000	9	Ball socket No. 25,620	Ohio Brass	11	Ball socket No. 26,240	
120	25	36	300	3.95	1,150; 2,760 B	△	66,000	4	Jeffery-Dewitt susp. A-257	Jeffery-Dewitt	5	Jeffery-Dewitt susp. A-257	Jef
120	25	36	200	1.75	1,470; 4,500 B	△	66,000	4	Jeffery-Dewitt susp. A-257	Jeffery-Dewitt	5	Jeffery-Dewitt susp. A-257	Jef
120	25	30	200	1.75	1,470; 4,500 B	△	66,000	4	Jeffery-Dewitt susp. A-257	Jeffery-Dewitt	5	Jeffery-Dewitt susp. A-257	Jef
	30	48	1,200	42.7	5,180; 9,400 B	Vertical	66,000	7(8)	Cap & pin susp. No. 25,620	Ohio Brass	7(8)	Cap and pin susp. No. 26,240	
	30	48	1,200	42.7	5,180; 9,400 B	Vertical	66,000	7(8)	Cap & pin susp. No. 25,620	Ohio Brass	7(8)	Cap and pin susp. No. 26,240	
	30	36	920	20.5	3,350	Vertical	66,000	6	Ball socket susp. No. 25,620	Ohio Brass	6	Ball socket susp. No. 26,240	
quiv.	25	30	175	1.83	900	"L" configuration	66,000	1 P.; 6 T.	Pin, poles; susp. 25,622 on twrs	Ohio Brass	4 on P. 7 on T.	No. 25,622 suspension	
quiv.	25	30	200	2.08	950	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspension	
quiv.	25	30	175	1.83	900	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspension	
83.16 P.	25	30	175 P.; 800 T.	1 P.; 23 T.	600 P.; 1,000 T.	Vertical	66,000	6	Pin, poles; disc, towers	Ohio Brass	8	Suspension	
	25	38 (45° swing)	1,000	23.7	3,300	Vertical	132,000	9	Suspension No. 25,620	Ohio Brass	11	No. 26,240 suspension	
	25	35 (45° swing)	800	23.9	2,180	Vertical	132,000	9	No. 25,622 suspension	Ohio Brass	11	No. 25,622 suspension	
	25	38 (45° swing)	1,000	23.7	3,300	Vertical	132,000	9	No. 25,620 suspension	Ohio Brass	11	No. 26,240 suspension	
	25	35 (45° swing)	800	23.9	2,180	Vertical	132,000	9	No. 25,622 suspension	Ohio Brass	11	No. 25,622 suspension	
quiv.	25	30	175	1.83	900	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 22,622 suspension	
	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	
	22	72	500	3.17	1,200	Vertical	90,000	6	Suspension	Lapp No. 2,300	7	Suspension	
	22	48	300	2.33	1,200	Horizontal	75,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	
	24	48	350	3.75	1,200	Horizontal	75,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	
	22	72	750	16	1,300	Vertical	90,000	6	Suspension No. 25,622	Ohio Brass	7	Suspension No. 25,620	
	22	48	200	2.33	1,200	Horizontal	75,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	
	23	48	300	2.33	1,200	Horizontal	75,000	5	Suspension	Westinghouse	6	Suspension	We
	22	42	300	2.33	1,200	Horizontal	75,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	
quiv.	22	30	150	1.5	750	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspension	
quiv.	25	30	200	2.08	950	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspension	
quiv.	22	30	150	1.5	750	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspension	
quiv.	25	30	150	1.5	750	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspension	
quiv.	25	30	150	1.5	750	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspension	
quiv.	25	30	200	2.08	950	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspension	
	28	43	1,000	26.25	2,950	Vertical	550,000(32)	8 and 9	Jeffery-Dewitt A-257	Jeffery-Dewitt	8 and 9(34)	Jeffery-Dewitt A-257	Jef
	35	47	700, 1,000	18.84, 38.45	2,975	Vertical	550,000(32)	8 and 9	Jeffery-Dewitt A-257	Jeffery-Dewitt	8 and 9(34)	Jeffery-Dewitt A-257	Jef
	28	43	1,000	26.25	2,950	Vertical	550,000(32)	8 and 9	Jeffery-Dewitt A-257	Jeffery-Dewitt	8 and 9(34)	Jeffery-Dewitt A-257	Jef
quiv.	25	30	175	1.83	900	Vertical	66,000	1	Pin	Ohio Brass	6	No. 25622 suspension	
quiv.	25	30	200	2.08	950	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspension	
quiv.	25	30	175	1.83	900	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspension	
quiv.	25	30	175	1.83	900	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspension	
	25	36	250	2.92	1,050	"L" configuration	66,000	5	Franklin suspension	E. S. supplies	5	Franklin suspension	E.
quiv.	25	30	175	1.83	900	Vertical	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspension	
20 horiz.	20	34	240	1.8	1,200	Vert. and hori.	66,000	5	Hewlett	Thomas	6	Hewlett	
20 horiz.	20	34	240	1.8	1,200	Vert. and hori.	66,000	5	Hewlett	Thomas	6	Hewlett	
nd 228 h.	20	30	700	8.5	1,650	Vertical	66,000	5	Hewlett	Thomas	6	Hewlett	
nd 228 h.	20	30	700	8.5	1,650	Vertical	66,000	5	Hewlett	Locke	6	Hewlett	
nd 252 h.	20	40	750	14	2,500	Vertical	66,000	5	Cem. cap ball and socket	Ohio Brass	6	Cemented cap ball and socket	O
	25	48	880	31	2,920	Vertical	580,000	8	A-257	Jeffery-Dewitt	9	A-257	Jef
ffset	24	28	750	21	4,000	Vertical	70,000	6	No. 25,622	Ohio Brass	7	No. 25,622	
ffset	50	32	800	24	7,400	Vertical	70,000	7	No. 2,094 and No. 5,960	Lapp	8	No. 2,094 and 5,960	
	25	28	400	12	3,000	Vertical	70,000	6	No. 25,620	Ohio Brass	8	No. 25,620	
ffset	24	28	660	24	3,000	Vertical	70,000	6	No. 5,960	Lapp	7	No. 5,960	
	25	48	700	19.5	1,635	Vertical	154,000	10 (11 top)	Suspension	Ohio Brass	12	Strain	
	26	60	450	5.5	1,500	Horizontal		4(20)		Jeffery-Dewitt	5		Jef
	25	100	880	31	2,950	Vertical		8	Jeffery-Dewitt	Jeffery-Dewitt	9	Jeffery-Dewitt	Jef
	26	60	450	5.5	1,500	Horizontal		10	Cap and pin	Locke	11	Cap and pin	
h.; 96 v.	25	28	660	14	1,160	Vertical	(22)	7	B. & S. suspension No. 18,400	Locke	8	B. & S. suspension No. 18,400	
h.; 84 v.	25	28	660	15.5	810	Vertical	(22)	7	B. & S. suspension No. 18,400	Locke	8	B. & S. suspension No. 18,400	
	25	108	880		9,000	Vert. and hori.	132,000	11	No. 25,620	Ohio Brass	22	No. 25,622	
4 h.; 84 v.	25	28	660	15.5	810	Vertical	(22)	7	B. & S. suspension No. 18,400	Locke	8	B. & S. suspension No. 18,400	
	Varies	42	1,000	12	6,300	Vertical	75,000	5	Suspension	W'hse No. 601	6	Suspension	W'h
	37	36	450 T.; 250 P.	11.8 T.; 5.7 P.	2,625 T.; 1,700 P.	V. towers; △ poles	390,000	5	Jeffery-Dewitt	Jeffery-Dewitt	5	High strength	
	25	48	880	31	2,920	Vertical	580,000	8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspension	Jef
	25	48	880	31	2,920	Vertical	580,000	8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspension	Jef
	25	48	880	31	2,920	Vertical	580,000	8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspension	Jef
	25	48	880	31	2,920	Vertical	580,000	8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspension	Jef
	25	48	500	11	3,100	Vertical	580,000	8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspension	Jef
	25	48	500	11	3,100	Vertical	580,000	8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspension	Jef
	25	48	880	31	2,920	Vertical	580,000	8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspension	Jef
	25	48	880	30.5	2,025	Vertical	580,000	8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspension	Jef
offset	29	36	800	17	6,000	Vertical	132,000	10 per string	No. 25,622	Ohio Brass	20 to 53	No. 25,622	
	25	48	520	13'9"	922	Vertical	460,000	10	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,622	
	25	48	600	14	1,050	△	460,000	10	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,622	
168	25	36	500	15	776	△	350,000	7	Ohio Brass No. 25,622	Ohio Brass	6	Ohio Brass No. 25,622	
4, 206	25	48				△	350,000	7	Suspension No. 10,566	Ohio Brass	8	Suspension No. 10,566	
	25	48	530	11	1,638	Vertical	425,000	9	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,622	
4,204	25	48	520	13'9"	922	△	460,000	10	Susp. No. 10,566; 12,464; 25,622	Ohio Brass	10—12	Suspension No. 10,566, 12,464	
	25	48	530	11	1,635	Vertical	425,000	9	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,622	
4, 206	25	48	520	13'9"	922	△	460,000	10	Suspension No. 12,464	Ohio Brass	10—12	Suspension No. 12,464	
	25	48	520	13'9"	922	Vertical	460,000	10	Suspension No. 25,622	Ohio Brass	10—12	Suspension No. 25,622	
	25	60	765	9½	1,490	Horizontal	550,000	10	Suspension No. 29,210	Ohio Brass	11	Suspension No. 29,210	
	25	60	660	16'11"	1,030	Vertical	550,000	10—11	Suspension No. 29,210	Ohio Brass	11—12	Suspension No. 29,210	
8	22	48	520	13' 9"	922	△	460,000	10	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,622	
	25	60	900	29'10"	2,211	Vertical	460,000	10—11	Suspension No. 25,620	Ohio Brass	11—12	Suspension No. 25,620	
4, 228.5	23	60	765	16	1,350	Unequal △	460,000	10	Suspension	Ohio Brass	11	Suspension No. 25,622	
	25	48	520	13' 9"	922	Vertical	460,000	10	Suspension No. 25,622	Ohio Brass	10—12	Suspension No. 25,622	
	25	48	520	13' 9"	922	Vertical	460,000	10	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,622	
5, 89	23	24	250	4	556	△	215,000	1	Pin No. 12,552	Ohio Brass	1	Pin No. 12,552	
4, 206	25	48	520	13' 9"	922	△	460,000	10	Susp. No. 10,566; 25,622; 29,219	Ohio Brass	10—12	Suspension No. 10,566	
	25	48	520	13' 9"	922	Vertical	460,000	10	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,622	
4, 206	25	48	520	13' 9"	922		460,000	10	Suspension No. 25,622	Ohio Brass	10—12	Suspension No. 25,622	
84	25		150	1	242		215,000	1	Pin No. 12,522	Ohio Brass	7	Suspension No. 25,622	
	25		125				215,000	1	Pin	Ohio Brass			
4, 204	25	48	520	13' 9"	922	△	493,000	10	Susp. No. 10,566; No. 25,622	Ohio Brass	12	Suspension No. 12,464	
24 offset	28	42	880	33.8	1,500	Vertical	120,000	9	No. 25,620	Ohio Brass	10	No. 25 620	
24 offset	28	42	880	33.8	1,500	Vertical	120,000	9	No. 25,620	Ohio Brass	10	No. 25,620	
24 offset	28	42	880	33.8	1,500	Vertical	120,000	9	No. 25,620	Ohio Brass	10	No. 25,620	
24 offset	28	42	880	33.8	1,500	Vertical	120,000	9	No. 25,620	Ohio Brass	10	No. 25,620	
36 offset	28	48	880	33.8	1,500	Vertical	120,000	9	No. 25,620	Ohio Brass	10	No. 25,620	
24 offset	28	42	880	33.8	1,500	Vertical	120,000	9	No. 25,620	Ohio Brass	10	No. 25,620	
36 offset	28	48	880	33.8	1,500	Vertical	120,000	9	No. 25,620	Ohio Brass	10	No. 25,620	
30 offset	30	54	900	31.2	2,100	Vertical	140,000	10	No. 25,620	Ohio Brass	11	No. 25,620	
24 offset	28	42	880	33.8	1,500	Vertical	120,000	9	No. 25,620	Ohio Brass	10	No. 25,620	
24 offset	28	42	880	33.8	2,200	Vertical	120,000	9	No. 25,620	Ohio Brass	10	No. 25,620	
24 offset	28	42	880	33.8	1,500	Vertical	120,000	7—9	No. A-257; No. 25,620	J.-D.; O. B.	8—10	No. A-257; No. 25,620	J.-D
30 offset	28	42	880	33.8	1,500	Vertical	120,000	9	No. 25,620	Ohio Brass	10	No. 25,620	
	35	48	550	17.5	1,100	Vertical	120,000	9	No. 641; No. 5,960	W'hse; Lapp	10	No. 641; No. 5,960	
	30	48	300	Al. Co. specif.	Al. Co. speci.	△	66,000	4	Suspension Hewlett	Thomas	5	Suspension Hewlett	
	45	72	600	Al. Co. specif.	Al. Co. speci.		88,000	6	Suspension Hewlett	Thomas	7	Suspension Hewlett	
106	27	33	175	2.7	210	△	70,000	1	Pin	O. B.; W'hse	1; 6(24)	Pin, suspension	
94	28	30	275	2.5	500	△	70,000	1	Pin	Ohio Brass	1; 6(24)	Pin No. 12,552	
61	28	30	275	2.5	500	△	70,000	1	Pin No. 12,552	Ohio Brass	1; 6(24)	Suspension No. 25,622	
106	25	33	300	3.83	700	△	80,000	5	Suspension	Lapp; W'hse	6	Suspension	
106	35	33	300	3.83	700	△	80,000	4	Suspension	O. B.; Lapp	5	Suspension	
	50	49⅞% susp;				Horizontal	85,000				7	Suspension No. 2,300	
	26	68⅛% dead	500	18.5	994	Horizontal	160,000	8	Suspension No. 7,500—T-2	Locke	9	Suspension No. 7,500—G-2	
	50	end				Horizontal	80,000				7	Suspension No. 2,300	
106	28	41	175	2.5	320	△	70,000	1	Pin	O. B.; W'hse	1; 6(24)	Pin, suspension No. 25,622	
on △	24	36	400	4.3	2,310	Vertical	80,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	
61	28	30	275	2.5	500	△	70,000	1	Pin	Ohio Brass	1; 6(24)	Pin, suspension No. 25,622	
106	25	33	300	3.83	700	△	80,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	
61	30	30	220	3	1,815	△	80,000	5	Suspension	Ohio Brass	6	Suspension	
72	24.5	24	200	2.7	240	△	70,000	1	Pin	Ohio Brass	2(24)	Pin	
106	28	41	175	2.5	320	△	70,000	1	Pin	O. B.; W'hse	1; 6(24)	Pin, suspension No. 26,522	
174	40	63	550—600	12	2,270	Vertical	120,000	8	Suspension No. 25,622	Ohio Brass	9	Suspension No. 25,622	
191	41.5	66	500	8	785	△	80,000	5	Suspension	Ohio Brass	6	Suspension	
61	28	30	250—300	2.5	500	△	66,000	1	Pin	Ohio Brass	6(24)	Pin, suspension	
102, 54	32 feet 6 in.	4.25	400	4.5	890, No. 2 solid, 2210 No. 2 str.	Vertical	70,050	1	Pin	Ohio Brass			
90	40	30	500	6.2	660	△	70,000	1	Waconia pin	O. B.; W'hse; La.	1	Waconia pin	O. B.
78	30	39	300	6.7	336	Horizontal	80,000	5	Suspension	Ohio Brass	6	Suspension	
191	6 in.	66	500	8	785	△	80,000	5; 1	Suspension, Waconia pin	Ohio Brass	6	Suspension	
61	28	30	275	2.5	500	△	70,000	3	Pin	Ohio Brass	1; 6(24)	Pin No. 12,552 suspension	
115	39	33	300	3.83	700	△	80,000	4	Suspension	Ohio Brass	5	Suspension	
94	28	30	250	2.67	435	△	70,000	3	Pin	O. B.; W'hse	1; 6(24)	Pin, suspension No. 25,622	
94	28	30	250	4.5	350	△	70,000		Pin	O. B.; W'hse	2(24)	Pin	
94	28	30	275	2.5	500	△	80,000	5	Suspension	Ohio Brass	6	Suspension	
72	29	42	300	3.7	2,000	△	70,000	5	Suspension No. 6,294	Lapp	6	Suspension No. 6,294	
94	33	30	220	3	1,815	△	80,000	5	Suspension	Ohio Brass	6	Suspension	
50	33	72	600	18	750	Horizontal	160,000	8	Suspension	Ohio Brass	9	Suspension	
182	36	58	650	12.5	1,700	△	160,000	8	Suspension	Ohio Brass	9	Suspension No. 25,622	
94	28	30	250	4.5	350	△	70,000	1	Pin	O. B.; W'hse	1; 6(24)	Pin, suspension	
	23	44	250	Cu. 2; A.C.S.R. 1.8	Cu. 600; A.C.S.R. 900	Unequal △	66,000	5	Clevis and pin disc	W'hse; Thomas	6	Clevis and pin disc	
	23	48	265	1.8	900	Unequal △	66,000	5	Hewlett Link	Thomas	6	Hewlett link	
	23	36	250, 100	3, 0.8		Unequal △	66,000	5	Clevis and pin	Ohio Brass	6	Clevis and pin	
	23	72	660	10.5	1,200	Horizontal	66,000	4	Hewlett Link	Thomas	5	Hewlett link	
	20	45.5	525	14		Vertical	66,000	4	Cap and Link, cap and pin	O. B.; Thomas	5	Cap and pin; ball socket con.	
	27	48	860	10.5	1,200	Vertical	66,000	5	Cap and pin disc No. 5,800	Locke	6	Cap and pin disc No. 5,800	
	27	48	480	8	785	Vertical	66,000	5	Cap and pin disc No. 57,139	Thomas	6	Cap and pin disc No. 57,139	
	20	48	650	18	800 approx.	Vertical	66,000	4	Ball socket disc	Ohio Brass	5	Ball socket disc	
	24		500	14.4	700	Vertical	66,000	5	Suspension No. 25,622	Ohio Brass	5	Suspension No. 25,622	
		31	200	2	500	△	66,000	1	Pin No. 7,210	Locke	2 (doubled armed)	Pin No. 7210	
	33	51	400	8.5	750	Horizontal	66,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	
		31	200	2	500	△	66,000	1	Pin No. 3,166	Westinghouse	2 (doubled armed)	Pin No. 3166	
	33	51	400	8.5	750	Horizontal	66,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	
	32	32	200	2	500	△	66,000	1	Pin No. 10,748	Ohio Brass	5	Suspension No. 25,622	
	24	32	500	14.4	700	Vertical	66,000	5	Suspension No. 25,622	Ohio Brass	5	Suspension No. 25,622	
	32	32	200	2	500	△	66,000	1	Pin No. 10,748	Ohio Brass	5	Suspension No. 25,622	
						Horizontal	66,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	
	Locke-Hewlett No. 9,140	Locke		Locke No. 8,700	Locke		No		Locke	Locke		Ohio Brass	
5	Locke 8400	Locke	6	Locke No. 8,700	Locke		No		Locke	Yes		Ohio Brass	
9	Locke-Hewlett No. 9,140	Locke	10	Locke-Hewlett No. 9,140	Locke		No		Locke	Locke		Ohio Brass and Locke	
10	Ohio Brass No. 25,620	Ohio Brass	11	Ohio Brass No. 25,620	Ohio Brass		No		Locke	Locke		Ohio Brass	
10	Locke-Hewlett No. 9,140	Locke	11	Locke-Hewlett No. 9,140	Locke		No			Locke		Ohio Brass suspension	
10	Locke No. 9,140	Locke	11	Locke-Hewlett No. 9,140	Locke		No			Locke		Ohio Brass	

Locke	No			Locke	Yes											
Locke	No			Locke	Locke				Ohio Brass and Locke		Compression joint	Oxide film			Copperweld	
Locke	No			Locke	Locke				Ohio Brass		Sleeves	Oxide film		G. E.	Copperweld	
Ohio Brass	No			Locke	Locke				Ohio Brass suspension		Sleeves	Oxide film		G. E.	Copperweld	
Locke	No				Locke				Ohio Brass		Sleeves	Oxide film		G. E.	Copperweld	
Locke	No			Locke	Locke				Ohio Brass		Sleeves	Oxide film		G. E.	Copperweld	
Ohio Brass	No								Ohio Brass suspension, 4/0		Aluminum double sleeve joint					
Ohio Brass	No		Ohio Brass on suspension only	None					Suspension and strain, .312—.687"		Lock splice	Oxide film		G. E.	Galvanized steel	
Ohio Brass	No		Ohio Brass on suspension only	None					Suspension and strain, .312—.687"		McIntyre sleeves	Oxide film		G. E.	Galvanized steel	
Ohio Brass	No		Ohio Brass on suspension only	None					Suspension and strain, .312—.687"		McIntyre sleeves	Oxide film		G. E.	Galvanized steel	
Ohio Brass	No		Ohio Brass on suspension only	None					Suspension and strain, .312—.687"		McIntyre sleeves	Oxide film		G. E.	Galvanized steel	
Jeffery-Dewitt	No		Jeffery-Dewitt on susp. only	None					Suspension and strain, 4/0		McIntyre sleeves	Oxide film		G. E.	Copperweld steel	
Ohio Brass	No		Ohio Brass on suspension only	None					Suspension and strain, .312—.687"		McIntyre sleeves	Oxide film		G. E.	None	
Ohio Brass	No								Ohio Brass No. 11,538; strain 11,543		Twist sleeves	Oxide film		G. E.	High strength steel	
J.-D.; O. B.	No		None						Ohio Brass No. 11,538; strain Aluminum No. 704		Twist sleeves	Oxide film		G. E.	High strength steel	
J.-D.; O. B.	No		None						Ohio Brass No. 11,538; Aluminum No. 704		Twist sleeves	Oxide film		G. E.	High strength steel	
Ohio Brass	No		Fused with grading ring (orig.)						Ohio Brass No. 70,730; strain 71,091		Twist sleeves	Oxide film		G. E.	High strength steel	
Ohio Brass	Yes	6	Fused, w. grading ring (mod'f'd)		15	30			Ohio Brass No. 70,730; strain 71,091		Twist sleeves	Oxide film		G. E.	High strength steel	
Ohio Brass	No								Ohio Brass No. 70,184; strain 73,515		Aluminum 2-pc. compression	Oxide		G. E.	Copperweld, high s	
Jeffery-Dewitt	No								Ohio Brass No. 11,538; strain 11,541		Twist sleeves	Oxide film		G. E.	High strength steel	
Jeffery-Dewitt	No								Ohio Brass No. 11,538 strain Aluminum No. 704;		Twist sleeves	Oxide film		G. E.	High strength steel	
Jeffery-Dewitt	No								Ohio Brass No. 11,538; strain Aluminum No. 704		Twist sleeves	Oxide film		G. E.	High strength steel	
Ohio Brass	No		Fused with grading ring (orig.)						Ohio Brass No. 70,730; strain 71,091		Twist sleeves	Oxide film		G. E.	High strength steel	
Ohio Brass	No		Fused with grading ring (orig.)						Ohio Brass No. 70,730; strain 71,091		Twist sleeves	Oxide film		G. E.	High strength steel	
Ohio Brass	No		Fused w. grading ring (mod'f'd)			13½x27			Ohio Brass No. 71,043; strain 73,515		Aluminum 2-pc. compression	Autovalve, oxide film		W'se, G. E.	A.C.S.R.	
Ohio Brass	No								Ohio Brass No. 11,541		Twist sleeves			G. E.	Copperweld strand	
Ohio Brass	No								Ohio Brass No. 11,541		Twist sleeves			G. E.	None	
Ohio Brass	No								Ohio Brass No. 11,541		Twist sleeves			G. E.	Cu.-weld str., twrs c	
Ohio Brass	No								Aluminum Company of America		Twist sleeves	One each end of each circuit;		G. E.	S.-M. steel str.	
Ohio Brass	No		Ohio Brass standard						Ohio Brass No. 71,041		Compression sleeves	oxide film		G. E.	A.C.S.R.	
Ohio Brass	No								Ohio Brass No. 11,542		Twist sleeves			G. E.	S.-M. steel str.	
Ohio Brass	No		Ohio Brass standard						Ohio Brass No. 71,041		Compression sleeves			G. E.	Cu.-weld, ex-hi-ten	
Ohio Brass	No		Few, ½ horn						Ohio Brass No. 11,542		Twist sleeves			G. E.	S.-M. steel str.	
Ohio Brass	No								Ohio Brass No. 11,541		Twist sleeves	3 oxide film		G. E.		
(14)	(14)	(14)	(14)	(14)	(14)	(14)			(14)		(14)	(14)		(14)	(14)	
Lapp	No								Lapp		Twist joints					
Ohio Brass	No								Ohio Brass No. 70,730		Twist joints					
Ohio Brass	No								Ohio Brass No. 70,730		Twist joints				Aluminum	
Ohio Brass	No								Ohio Brass No. 70,730		Twist joints					
Westinghouse	No								Ohio Brass No. 70,730		Twist joints					
Ohio Brass	No								Ohio Brass No. 70,730		Twist joints					
Ohio Brass	No								Ohio Brass No. 11,541		Twist sleeves	1 oxide film; 1 s. v.		G. E.; W'se	Copperweld strand	
Ohio Brass	No								Ohio Brass No. 11,541		Twist sleeves	3 oxide film		G. E.		
Ohio Brass	No								Ohio Brass No. 11,541		Twist sleeves	1 oxide film; 2 s. v.		G. E., W'se	Copperweld strand	
Ohio Brass	No								Ohio Brass No. 11,541		Twist sleeves	Oxide film (each end)		G. E.		
Ohio Brass	No								Ohio Brass No. 11,541		Twist sleeves	3 oxide film		G. E.	Copperweld strand	
Ohio Brass	No								Ohio Brass No. 11,541		Twist sleeves	Oxide film (each end)		G. E.		
Jeffery-Dewitt	No		Ohio Brass						Ohio Brass No. 73,179		Hydraulic compression	Oxide film		G. E.	Galvanized steel s	
Jeffery-Dewitt	No		Jeffery-Dewitt		Oval				Jeffery-Dewitt CH 200 and S 400		Cu. sleeves twisted 4 times	Oxide film		G. E.	Galvanized steel s	
Jeffery-Dewitt	No		Ohio Brass						Ohio Brass No. 73,179		Hydraulic compression	Oxide film		G. E.	Galvanized steel s	
Ohio Brass	No								Ohio Brass No. 11,541		Twist sleeves	Oxide film		G. E.		
Ohio Brass	No								Ohio Brass No. 11,541		Twist sleeves	Oxide film		G. E.		
Ohio Brass	No								Ohio Brass No. 11,541		Twist sleeves	Oxide film		G. E.		
Ohio Brass	No								Ohio Brass No. 11,541		Twist sleeves	Oxide film		G. E.		
E. S. supplies	No								Ohio Brass No. 11,541		Twist sleeves	Oxide film		G. E.		
Ohio Brass	No								Ohio Brass No. 11,541		Twist sleeves	Oxide film		G. E.		
Thomas	No		Plain						Thomas No. 10,092; strain Ohio Brass 11,328		Twist sleeves	Oxide film		G. E.	Siemens-Martin st	
Thomas	No		Plain						Thomas No. 10,092; strain Ohio Brass 11,328		Twist sleeves	Oxide film		G. E.	Siemens-Martin st	
Thomas	No		Plain						Thomas No. 5,717 strain Ohio Brass 70,231		Compression joint	Oxide film		G. E.	Siemens-Martin st	
Locke	No		Plain						Thomas 10,092; Locke 3,045; Ohio Brass 70,231		Twist sleeves	Oxide film		G. E.	Siemens-Martin st	
Ohio Brass	No		Plain						Ohio Brass Nos. 70,701; 70,249; 70,250		Compressed joint	Oxide film		G. E.	Siemens-Martin st	
Jeffery-Dewitt	No								Jeffery-Dewitt C 200; Jeffery-Dewitt D 306		Twist sleeves	Oxide film		G. E., El. Pr. Eq.	A.C.S.R.	
Ohio Brass	No		Special design						Ohio Brass No. 73,511, 13½"		Sleeve compression	Oxide film		G. E.	A.C.S.R.	
Lapp	No		Special design						Ohio Brass No. 70,731, 9¾", 12¾"		Sleeve compression	Oxide film		G. E.	Red brass	
Ohio Brass	No								Ohio Brass No. 11,041, 8¼"		Sleeve compression	Aluminum		G. E.	Copperweld	
Lapp	No		Special design						Ohio Brass No. 73,037; Ohio Brass 73,509		Sleeve compression	Oxide film		G. E.	A.C.S.R.	
Ohio Brass	No		Ohio Brass flux controls						Thomas No. 10,091 suspension, 8"		Sleeves	Autovalve		W'hse		
Jeffery-Dewitt	No															
Jeffery-Dewitt	No								Locke trunnion		Compression	Oxide film (at terminals)		G. E.		
Locke	No											Oxide film (at terminals)		G. E.		
Locke			Yes						Ohio Brass No. 70,756 and No. 71,091		Tw. sl.; compr. sl. for core	Oxide film B. O.		G. E.	A.C.S.R.	
Locke			Yes						Ohio Brass No. 72,703 and No. 70,756		Tw. sl.; compr. sl. for core	Oxide film B. O.		G. E.	A.C.S.R.	
Ohio Brass	No								Ohio Brass		Compression	2		G. E.	Aluminum	
Locke			Yes						Locke No. 118 Universal		Twist sleeves	Oxide film B. O.		G. E.	Copperweld (30	
W'hse No. 631	No											Oxide film (each end)		G. E.		
Lapp	No								Jeffery-Dewitt C-300; strain Ohio Brass No. 70,231		Twist sleeves	Oxide film		G.E.	A.C.S.R.	
Jeffery-Dewitt	No								Jeffery-Dewitt C-200; strain D-306		Twist sleeves				A.C.S.R.	
Jeffery-Dewitt	No								Jeffery-Dewitt C-200; strain D-306		Twist sleeves				A.C.S.R.	
Jeffery-Dewitt	No								Jeffery-Dewitt C-200; strain D-306		Twist sleeves				A.C.S.R.	
Jeffery-Dewitt	No								Jeffery-Dewitt C-200; strain D-306		Twist sleeves				A.C.S.R.	
Jeffery-Dewitt	No					22			Jeffery-Dewitt F-200; strain S-400		Twist sleeves				A.C.S.R.	
Jeffery-Dewitt	No								Jeffery-Dewitt C-200; strain S-400		Twist sleeves	Oxide film		G. E.	A.C.S.R.	
Jeffery-Dewitt	No								Jeffery-Dewitt C-200; strain S-400		Twist sleeves				A.C.S.R.	
Jeffery-Dewitt	No								Jeffery-Dewitt C-200; strain S-400		Compressor joints				A.C.S.R.	
Ohio Brass	No								Ohio Brass No. 70,731, 9¾"		Sleeve compression					
Ohio Brass	No		Flux control						Thomas No. 10,089, 8"		Sleeves	Aluminum cell		G. E.		
Ohio Brass	No		15						Thomas No. 10,089, 8"		Sleeves	Oxide film		G. E.		
Ohio Brass	No		15						Thomas No. 10,089, 8"		Twist sleeves	Aluminum cell at ends		G. E.		
Ohio Brass	No								Ohio Brass No. 11,026		Twist sleeves	Aluminum cell at ends		G. E.		
Ohio Brass	No		Flux control						Thomas No. 10,089, 8"		Sleeves	Aluminum cell; ox. film		G. E.		
Ohio Brass	No		24						Thomas No. 10,089, 8"		Sleeves	Aluminum cell; ox. film		G. E.		
Ohio Brass	No		Ohio Brass flux control						Thomas No. 10,091, 8"		Twist sleeves	Aluminum cell; ox. film		G. E.	Copperweld—A	
Ohio Brass	No		24						Thomas No. 10,089, 8"		Sleeves	Aluminum cell		G. E.		
Ohio Brass	No		24						Locke No. 13,916—G-3, 9"		Sleeves	Aluminum cell; ox. film		G.E.		
Ohio Brass	No		24						Thomas No. 10,091, 8"		Seamless sleeves	Aluminum cell		G. E.	Copperweld	
Ohio Brass	No		24						Thomas No. 10,091, 8"		Twist sleeves					
Ohio Brass	No		Special						Thomas No. 10,089, 8"		Twist seamless sleeves	Oxide film		G. E.		
Ohio Brass	No		17						Thomas No. 10,091, 8"		Sleeves	Oxide film		G. E.	Copperweld	
Ohio Brass	No		17						Thomas No. 10,091, 8"		Aluminum sleeves	Oxide film		G. E.	A.C.S.R.	
Ohio Brass	No		24						Ohio Brass No. 11,538, 9"		Sleeves	Aluminum cell		G. E.	Copperweld	
Ohio Brass	No		15						Thomas No. 10,091, 8"		Compression joint	Aluminum cell		G. E.		
Ohio Brass	No										Sleeves	Aluminum cell		G. E.	Iron	
Ohio Brass	No		15; 24								Sleeves	Aluminum cell		G. E.		
Ohio Brass	No		24						Thomas No. 10,089, 8"		Sleeves	Aluminum cell		G. E.		
Ohio Brass	No		24						Ohio Brass No. 11,538, 9"		Sleeves	Aluminum cell		G. E.		
Ohio Brass	No								Thomas No. 10,089, 8"		Twist sleeves	Aluminum cell		G. E.		
Ohio Brass	No										Twist sleeves	Aluminum cell; oxide film		G. E.		
Ohio Brass	No		15						Thomas No. 10,089, 8"		Sleeves	Aluminum cell; oxide film		G. E.		
Ohio Brass	No		Ohio Brass No. 70,756						Ohio Brass No. 70,756		Twist sleeves	Oxide film		G. E.	Cu.	
Ohio Brass	No		Ohio Brass No. 70,756						Ohio Brass No. 70,756		Twist sleeves	Oxide film		G. E.	Cu.	
Ohio Brass	No		Ohio Brass No. 70,756						Ohio Barss No. 70,756		Twist sleeves	Oxide film		G. E.	Cu.	
Ohio Brass	No		Ohio Brass No. 70,756						Ohio Brass No. 70,756		Twist sleeves	Oxide film		G. E.	Cu.	
Ohio Brass	No		Ohio Brass No. 70,756						Ohio Brass No. 70,756		Drawn sleeve	Oxide film		G. E.	Cu.	
Ohio Brass	No		Ohio Brass No. 70,756						Ohio Brass No. 70,756		Twist sleeves	Oxide film		G. E.	Cu.	
Ohio Brass	No		Ohio Brass No. 70,756						Ohio Brass No. 70,756		Twist sleeves	Auto-valve and oxide film		W'hse; G.E.	Cu.	
Ohio Brass	No		Ohio Brass No. 70,756						Ohio Brass No. 70,756		Twist sleeves and drawn sleeves	Auto-valve		W'hse	Copperweld	
Ohio Brass	No		Ohio Brass No. 70,756						Ohio Brass No. 70,756		Twist sleeves	Auto-valve and oxide film		W'hse; G.E.	Cu.	
J.-D.; O. B.	No		Ohio Brass No. 70,756						Ohio Brass No. 70,756		Twist sleeves	Oxide film		G. E.	Cu.	
Ohio Brass	No		Ohio Brass No. 70,756						Oyio Brass No. 70,756		Twist sleeves	Oxide film		G. E.	Cu.	
Lapp; W'hse	No		W'hse 503,759; O. B. 70,756						Ohio Brass No. 70,756		Twist sleeves	Oxide film		G. E.	Cu.	
									West. No. 503,759; Ohio Brass No. 70,756		Drawn sleeve	Oxide film		G. E.	Cu.	
Thomas	No		Yes								Sleeves	Oxide film		G. E.		
Thomas	No		Yes								Sleeves	Oxide film		G. E.		
O. B.; W'hse									Tie wire Ohio Brass No. 11,543 on dead-ends and corners		Sleeves	Oxide film		G. E.	Siemens-Martin	
Ohio Brass											Sleeve	Oxide film		G. E.	Siemens-Martin	
Lapp; W'hse									Lapp No. 5,573		Sleeve				Siemens-Martin	
Lapp No. 2,300									Lapp No. 5,573		Sleeve	Oxide film		G. E.	Siemens-Martin	
Lapp									Crosby		Sleeve	Electrolytic; oxide film		G. E.	Siemens-Martin	
Locke									Locke No. 8,451—G-1		Sleeve	Oxide film		G. E.		
Lapp									Crosby		Sleeve	Oxide film		G. E.	Siemens-Martin	
O. B.; W'hse									Tie wire Ohio Brass No. 11,543		Sleeve	Oxide film		G. E.		
Ohio Brass			Clamps						Ohio Brass No. 70,701 with arcing hor. s		Sleeve	Oxide film; electrolytic		G.E.; W'hse	Siemens-Martin	
Ohio Brass									Tie wire Ohio Brass No. 11,543		Sleeve	Oxide film		G. E.	Siemens-Martin	
Ohio Brass									Lapp No. 5,573		Sleeve				Siemens-Martin	
Ohio Brass									Ohio Brass No. 70,249		Sleeve	Oxide film		G. E.	Siemens-Martin	
O. B.; W'hse									Tie wire		Sleeve	Electrolytic		G. E.	Siemens-Martin	
Ohio Brass									Tie wire Ohio Brass No. 11,543			Oxide film		G. E.	Siemens-Martin	
Ohio Brass									Ohio Brass No. 70,249; 11,543		Sleeve	Oxide film		G. E.	Siemens-Martin	
Ohio Brass									Ohio Brass No. 70,249		Sleeve	Oxide film		G. E.		
									Tie wire Ohio Brass No. 11,543			Oxide film		G. E.	Siemens-Martin	
O. B.; W'hse; L.									Tie wire		Sleeve	Oxide film		G. E.	Iron	
Ohio Brass									Tie wire		Sleeve	Electrolytic; oxide film		G. E.	Iron	
Ohio Brass									Ohio Brass No. 70,249		Sleeve	Electrolytic		G. E.	Siemens-Martin	
Ohio Brass									Ohio Brass No. 70,249		Sleeve	Electrolytic		W'hse	Siemens-Martin	
O. B.; Lapp									Tie wire Ohio Brass No. 11,543		Sleeve	Oxide film		G. E.	Siemens-Martin	
O. B.; W'hse									Ohio Brass No. 70,249		Sleeve	Oxide film		G. E.	Siemens-Martin	
O. B.; W'hse									Tie wire Ohio Brass No. 11,543		Sleeve	Oxide film		G. E.	Siemens-Martin	
Ohio Brass									Tie wire		Sleeve				Siemens-Martin	
Lapp									Ohio Brass No. 70,249		Sleeve				Siemens-Martin	
Ohio Brass									Lapp No. 5,573		Sleeve	Oxide film		G. E.	Siemens-Martin	
Ohio Brass									Ohio Brass No. 70,249		Sleeve	Oxide film		G. E.	Siemens-Martin	
Ohio Brass									Ohio Brass No. 73,430		Sleeve	Oxide film		G. E.	Siemens-Martin	
O. B.; W'hse									Ohio Brass No. 70,249		Sleeve	Oxide film		G. E.	Siemens-Martin	
									Tie wire Ohio Brass No. 11,543		Sleeve	Oxide film		G. E.	Siemens-Martin	
W'hse; Thomas									Thomas No. 10,005 and 10,062		Twist sleeve	Oxide film		G. E.		
Thomas											Twist sleeve	Oxide film		G. E.		
Ohio Brass									4-bolt		Twist sleeve	Oxide film		G. E.	Steel strand	
Thomas									Ohio Brass No. 72,366		McIntyre sleeve No. 527	Oxide film		G. E.		
Locke									Thomas No. 10,002		Double barrel twist sleeve	Aluminum cell; oxide film		G. E.	Steel strand	
Thomas									Ohio Brass No. 72,366		McIntyre sleeve No. 527	Oxide film		G. E.		
Ohio Brass									Clevis-3-bolt, 68—.30"		3-section sleeve	Oxide film		G. E.		
									4-bolt		Double barrel twist sleeve	Oxide film; auto-valve		G.E.; W'hse	Steel strand	
Ohio Brass									Ohio Brass No. 70,755		Cu. sleeve splice	1 electrolytic; 1 auto-valve; 2 ox. film		G.E.; W'hse	Galv. steel str	
Locke											Sleeve splice	S. V. auto-valve		W'hse		
Ohio Brass									Ohio Brass No. 11,538		Sleeve splice	S. V. auto-valve		W'hse		
Westinghouse											Sleeve splice	Oxide film		G. E.		
Ohio Brass									Ohio Brass No. 11,538		Cu. sleeve splice	2 oxide film; 3 S. V.		G.E.; W'hse		
Ohio Brass											Sleeve splice	3 electrolytic; 1 S. V.		W'hse		
Ohio Brass									Ohio Brass No. 70,755		Cu. sleeve splice	2 S. V.; 4 electrolytic; 3 oxide film		W'hse; G.E.	Galv. steel str	
Ohio Brass											Sleeve splice	Electrolytic		W'hse		
Ohio Brass									Ohio Brass No. 11,538		Cu. sleeve splice	Oxide film		G. E.		
									Ohio Brass No. 11,538		Cu. sleeve splice	Oxide film		G. E.		

Compression joint	Oxide film (at one end)								
Sleeves	Oxide film	G. E.	Copperweld	½	1	Through clamp	Leased wire	19	
Compression joint	Oxide film		Copperweld	⅜	1	Suspension clamp	Radio and leased wire	20	
Sleeves	Oxide film	G. E.	Copperweld	⅜	1	Suspension clamp	Radio and leased lines	21	
Sleeves	Oxide film	G. E.	Copperweld	½	1	Suspension clamp	Leased line	22	
Sleeves	Oxide film	G. E.	Copperweld	½	1	Suspension clamp	Leased wire	23	

55	51	400	8.5	750		66,000	5	Suspension No. 25,622	Ohio Brass	6		Suspension No. 25,622
.....	31	200	2	500	Horizontal	66,000	1	Pin No. 3,166	Westinghouse	2 (doubled armed)		Pin No. 3166
33	51	400	8.5	750	△	66,000	5	Suspension No. 25,622	Ohio Brass	6		Suspension No. 25,622
32	32	200	2	500	Vertical	66,000	1	Pin No. 10,748	Ohio Brass	5		Suspension No. 25,622
24	32	500	14.4	700	△	66,000	5	Suspension No. 25,622	Ohio Brass	5		Suspension No. 25,622
32	32	200	2	500	Horizontal	66,000	1	Pin No. 10,748	Ohio Brass	5		Suspension No. 25,622
								Suspension No. 25,622	Ohio Brass	6		Suspension No. 25,622

...	...	...	...	...	...	No	...	Locke	Locke	...	...	Ohio Brass
5	Locke 8400	Locke	6	Locke No. 8,700	Locke	No	...	Locke	Yes	...	...	Ohio Brass
9	Locke-Hewlett No. 9,140	Locke	10	Locke-Hewlett No. 9,140	Locke	No	...	Locke	Locke	...	...	Ohio Brass and Locke
10	Ohio Brass No. 25,620	Ohio Brass	11	Ohio Brass No. 25,620	Ohio Brass	No	...	Locke	Locke	...	...	Ohio Brass
10	Locke-Hewlett No. 9,140	Locke	11	Locke-Hewlett No. 9,140	Locke	No	...	Locke	Locke	...	...	Ohio Brass suspension
10	Locke No. 9,140	Locke	11	Locke-Hewlett No. 9,140	Locke	No	...	.....	Locke	...	...	Ohio Brass
							...	Locke	Locke	...	...	Ohio Brass
5	10" suspension disc	Ohio Brass	6	10" suspension disc	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass suspension, 4/0
5	Suspension	Ohio Brass	6	Suspension	Ohio Brass	No	...	Ohio Brass on suspension only	None	...	...	Suspension and strain, .312—.687"
6	Suspension	Ohio Brass	6	Suspension	Ohio Brass	No	...	Ohio Brass on suspension only	None	...	...	Suspension and strain, .312—.687"
5	Suspension	Ohio Brass	6	Suspension	Ohio Brass	No	...	Ohio Brass on suspension only	None	...	...	Suspension and strain, .312—.687"
5	Suspension	Ohio Brass	6	Suspension	Ohio Brass	No	...	Ohio Brass on suspension only	None	...	...	Suspension and strain, .312—.687"
9	Suspension	Jeffery-Dewitt	11	Suspension	Jeffery-Dewitt	No	...	Jeffery-Dewitt on susp. only	None	...	...	Suspension and strain, 4/0
5	Suspension	Ohio Brass	6	Suspension	Ohio Brass	No	...	Ohio Brass on suspension only	None	...	...	Suspension and strain, .312—.687"
5	Cap & pin susp. No. 25,620	Ohio Brass	6	Cap and pin susp. No. 26,240	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass No. 11,536; strain 11,543
4, 5	J.-D. susp.; cap & pin susp.	J.-D.; O. B.	5, 6	Jeffery-Dewitt & O. B. susp.	J.-D.; O. B.	No	...	None	.....	...	...	Ohio Brass No. 11,536; strain Aluminum No.
4, 5	J.-D. susp.; cap & pin susp.	J.-D.; O. B.	5, 6	J.-D. susp and cap & pin susp.	J.-D.; O. B.	No	...	None	.....	...	...	Ohio Brass No. 11,536; Aluminum No. 704
7(8)	Cap & pin susp. No. 25,620	Ohio Brass	7(8)	Cap and pin susp. No. 26,240	Ohio Brass	No	...	Fused with grading ring (orig.)	.....	...	...	Ohio Brass No. 70,730; strain 71,091
8	Cap & pin susp. No. 25,620	Ohio Brass	8	Cap and pin susp. No. 26,240	Ohio Brass	Yes	6	Fused, w. grading ring (mod'f'd)	.....	15	30	Ohio Brass No. 70,730; strain 71,091
9	Ball socket No. 25,620	Ohio Brass	11	Ball socket No. 26,240	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass No. 70,184; strain 73,515
4	Jeffery-Dewitt susp. A-257	Jeffery-Dewitt	5	Jeffery-Dewitt susp. A-257	Jeffery-Dewitt	No	...	.....	.....	...	...	Ohio Brass No. 11,536; strain 11,541
4	Jeffery-Dewitt susp. A-257	Jeffery-Dewitt	5	Jeffery-Dewitt susp. A-257	Jeffery-Dewitt	No	...	.....	.....	...	...	Ohio Brass No. 11,536 strain Aluminum No.
4	Jeffery-Dewitt susp. A-257	Jeffery-Dewitt	5	Jeffery-Dewitt susp. A-257	Jeffery-Dewitt	No	...	.....	.....	...	...	Ohio Brass No. 11,536; strain Aluminum No.
7(8)	Cap & pin susp. No. 25,620	Ohio Brass	7(8)	Cap and pin susp. No. 26,240	Ohio Brass	No	...	Fused with grading ring (orig.)	.....	...	...	Ohio Brass No. 70,730; strain 71,091
7(8)	Cap & pin susp. No. 25,620	Ohio Brass	7(8)	Cap and pin susp. No. 26,240	Ohio Brass	No	...	Fused with grading ring (orig.)	.....	...	...	Ohio Brass No. 70,730; strain 71,091
6	Ball socket susp. No. 25,620	Ohio Brass	6	Ball socket susp. No. 26,240	Ohio Brass	No	...	Fused w. grading ring (mod'f'd)	.....	...	13½x27	Ohio Brass No. 71,043; strain 73,515
1 P.; 6 T.	Pin, poles; susp. 25,622 on twrs	Ohio Brass	4 on P. 7 on T.	No. 25,622 suspension	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass No. 11,541
1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass No. 11,541
1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass No. 11,541
6	Pin, poles; disc, towers	Ohio Brass	8	Suspension	Ohio Brass	No	...	.....	.....	...	...	Aluminum Company of America
9	Suspension No. 25,620	Ohio Brass	11	No. 26,240 suspension	Ohio Brass	No	...	Ohio Brass standard	.....	...	...	Ohio Brass No. 71,041
9	No. 25,622 suspension	Ohio Brass	11	No. 25,622 suspension	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass No. 11,542
9	No. 25,620 suspension	Ohio Brass	11	No. 26,240 suspension	Ohio Brass	No	...	Ohio Brass standard	.....	...	...	Ohio Brass No. 71,041
9	No. 25,622 suspension	Ohio Brass	11	No. 25,622 suspension	Ohio Brass	No	...	Few, ½ horn	.....	...	...	Ohio Brass No. 11,542
1	Pin	Ohio Brass	6	No. 22,622 suspension	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass No. 11,541
(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)
6	Suspension	Lapp No. 2,300	7	Suspension	Lapp	No	...	.....	.....	...	...	Lapp
5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass No. 70,730
5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass No. 70,730
6	Suspension No. 25,622	Ohio Brass	7	Suspension No. 25,620	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass No. 70,730
5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass No. 70,730
5	Suspension	Westinghouse	6	Suspension	Westinghouse	No	...	.....	.....	...	...	.....
5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass No. 70,730
1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass No. 11,541
1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass No. 11,541
1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass No. 11,541
4	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass No. 11,541
1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass No. 11,541
1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass No. 11,541
8 and 9	Jeffery-Dewitt A-257	Jeffery-Dewitt	8 and 9(24)	Jeffery-Dewitt A-257	Jeffery-Dewitt	No	...	Ohio Brass	.....	...	...	Ohio Brass No. 73,179
8 and 9	Jeffery-Dewitt A-257	Jeffery-Dewitt	8 and 9(24)	Jeffery-Dewitt A-257	Jeffery-Dewitt	No	...	Jeffery-Dewitt	.....	Oval	...	Jeffery-Dewitt CH 200 and 8 400
8 and 9	Jeffery-Dewitt A-257	Jeffery-Dewitt	8 and 9(24)	Jeffery-Dewitt A-257	Jeffery-Dewitt	No	...	Ohio Brass	.....	...	...	Ohio Brass No. 73,179
1	Pin	Ohio Brass	6	No. 25622 suspension	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass No. 11,541
1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass No. 11,541
1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass No. 11,541
1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass No. 11,541
5	Franklin suspension	E. S. supplies	5	Franklin suspension	E. S. supplies	No	...	.....	.....	...	...	Ohio Brass No. 11,541
1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass No. 11,541
5	Hewlett	Thomas	6	Hewlett	Thomas	No	...	Plain	.....	...	...	Thomas No. 10,092; strain Ohio Brass 11,32
5	Hewlett	Thomas	6	Hewlett	Thomas	No	...	Plain	.....	...	...	Thomas No. 10,092; strain Ohio Brass 11,32
5	Hewlett	Thomas	6	Hewlett	Thomas	No	...	Plain	.....	...	...	Thomas No. 5,717 strain Ohio Brass 70,231
5	Hewlett	Locke	6	Hewlett	Locke	No	...	Plain	.....	...	...	Thomas 10,092; Locke 3,045; Ohio Brass 70,2
5	Cem. cap ball and socket	Ohio Brass	6	Cemented cap ball and socket	Ohio Brass	No	...	Plain	.....	...	...	Ohio Brass Nos. 70,701; 70,249; 70,250
8	A-257	Jeffery-Dewitt	9	A-257	Jeffery-Dewitt	No	...	.....	.....	...	...	Jeffery-Dewitt C 200; Jeffery-Dewitt D 306
6	No. 25,622	Ohio Brass	7	No. 25,622	Ohio Brass	No	...	Special design	.....	...	...	Ohio Brass No. 73,511, 13½"
7	No. 2,094 and No. 5,960	Lapp	8	No. 2,094 and 5,960	Lapp	No	...	Special design	.....	...	...	Ohio Brass No. 70,731, 70,231, 9¾", 12¾"
6	No. 25,620	Ohio Brass	8	No. 25,620	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass No. 11,041, 8¼"
6	No. 5,960	Lapp	7	No. 5,960	Lapp	No	...	Special design	.....	...	...	Ohio Brass No. 73,037; Ohio Brass 73,5
10 (11 top)	Suspension	Ohio Brass	12	Strain	Ohio Brass	No	...	Ohio Brass flux controls	.....	...	...	Thomas No. 10,091 suspension, 8"
4(20)	.....	Jeffery-Dewitt	5	.....	Jeffery-Dewitt	No	...	.....	.....	...	...	.....
8	Jeffery-Dewitt	Jeffery-Dewitt	9	Jeffery-Dewitt	Jeffery-Dewitt	No	...	.....	.....	...	...	Locke trunnion
10	Cap and pin	Locke	11	Cap and pin	Locke	No	...	.....	.....	...	...	.....
7	B. & S. suspension No. 18,400	Locke	8	B. & S. suspension No. 18,400	Locke	.....	...	Yes	.....	...	...	Ohio Brass No. 70,756 and No. 71,091
7	B. & S. suspension No. 18,400	Locke	8	B. & S. suspension No. 18,400	Locke	.....	...	Yes	.....	...	...	Ohio Brass No. 72,703 and No. 70,756
11	No. 25,620	Ohio Brass	22	No. 25,622	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass
7	B. & S. suspension No. 18,400	Locke	8	B. & S. suspension No. 18,400	Locke	.....	...	Yes	.....	...	...	Locke No. 118 Universal
5	Suspension	W'hse No. 601	6	Suspension	W'hse No. 631	No	...	.....	.....	...	...	.....
5	Jeffery-Dewitt	Jeffery-Dewitt	5	High strength	Lapp	No	...	.....	.....	...	...	Jeffery-Dewitt C-300; strain Ohio Brass No. 70
8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspension	Jeffery-Dewitt	No	...	.....	.....	...	...	Jeffery-Dewitt C-200; strain D-306
8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspension	Jeffery-Dewitt	No	...	.....	.....	...	...	Jeffery-Dewitt C-200; strain D-306
8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspension	Jeffery-Dewitt	No	...	.....	.....	...	...	Jeffery-Dewitt C-200; strain D-306
8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspension	Jeffery-Dewitt	No	...	.....	.....	...	...	Jeffery-Dewitt C-200; strain D-306
8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspension	Jeffery-Dewitt	No	...	.....	.....	...	22	Jeffery-Dewitt F-200; strain 8-400
8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspension	Jeffery-Dewitt	No	...	.....	.....	...	...	Jeffery-Dewitt C-200; strain 8-400
8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspension	Jeffery-Dewitt	No	...	.....	.....	...	...	Jeffery-Dewitt C-200; strain 8-400
8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspension	Jeffery-Dewitt	No	...	.....	.....	...	...	Jeffery-Dewitt C-200; strain 8-400
10 per string	No. 25,622	Ohio Brass	20 to 53	No. 25,622	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass No. 70,731, 9¾"
10	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,622	Ohio Brass	No	...	Flux control	.....	...	...	Thomas No. 10,089, 8"
10	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,622	Ohio Brass	No	...	15	.....	...	...	Thomas No. 10,089, 8"
7	Ohio Brass No. 25,622	Ohio Brass	6	Ohio Brass No. 25,622	Ohio Brass	No	...	15	.....	...	...	Thomas No. 10,089, 8"
7	Suspension No. 10,566	Ohio Brass	8	Suspension No. 10,566	Ohio Brass	No	...	.....	.....	...	...	Ohio Brass No. 11,026
9	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,622	Ohio Brass	No	...	Flux control	.....	...	...	Thomas No. 10,089, 8"
10	Susp. No. 10,566; 12,464; 25,622	Ohio Brass	10—12	Suspension No. 10,566, 12,464	Ohio Brass	No	...	24	.....	...	...	Thomas No. 10,089, 8"
9	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,622	Ohio Brass	No	...	Ohio Brass flux control	.....	...	...	Thomas No. 10,091, 8"
10	Suspension No. 12,464	Ohio Brass	10—12	Suspension No. 12,464	Ohio Brass	No	...	24	.....	...	...	Thomas No. 10,089, 8"
10	Suspension No. 25,622	Ohio Brass	10—12	Suspension No. 25,622	Ohio Brass	No	...	24	.....	...	...	Locke No. 13,916—G-3, 9"
10	Suspension No. 29,210	Ohio Brass	11	Suspension No. 29,210	Ohio Brass	No	...	24	.....	...	...	Thomas No. 10,091, 8"
10—11	Suspension No. 29,210	Ohio Brass	11—12	Suspension No. 29,210	Ohio Brass	No	...	24	.....	...	...	Thomas No. 10,091, 8"
10	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,622	Ohio Brass	No	...	Special	.....	...	...	Thomas No. 10,089, 8"
10—11	Suspension No. 25,620	Ohio Brass	11—12	Suspension No. 25,620	Ohio Brass	No	...	17	.....	...	...	Thomas No. 10,091, 8"
10	Suspension	Ohio Brass	11	Suspension No. 25,622	Ohio Brass	No	...	17	.....	...	...	Thomas No. 10,091, 8"
10	Suspension No. 25,622	Ohio Brass	10—12	Suspension No. 25,622	Ohio Brass	No	...	24	.....	...	...	Ohio Brass No. 11,538, 9"
10	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,622	Ohio Brass	No	...	15	.....	...	...	Thomas No. 10,091, 8"
1	Pin No. 12,552	Ohio Brass	1	Pin No. 12,552	Ohio Brass	No	...	.....	.....	...	...	.....
10	Susp. No. 10,566; 25,622; 29,219	Ohio Brass	10—12	Suspension No. 10,566	Ohio Brass	No	...	15; 24	.....	...	...	.....
10	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,622	Ohio Brass	No	...	24	.....	...	...	Thomas No. 10,089, 8"
10	Suspension No. 25,622	Ohio Brass	10—12	Suspension No. 25,622	Ohio Brass	No	...	24	.....	...	...	Ohio Brass No. 11,538, 9"
1	Pin No. 12,522	Ohio Brass	7	Suspension No. 25,622	Ohio Brass	No	...	.....	.....	...	...	Thomas No. 10,089, 8"
1	Pin	Ohio Brass	.....	.....	.....	No	...	.....	.....	...	...	.....
10	Susp. No. 10,566; No. 25,622	Ohio Brass	12	Suspension No. 12,464	Ohio Brass	No	...	15	.....	...	...	Thomas No. 10,089, 8"
9	No. 25,620	Ohio Brass	10	No. 25,620	Ohio Brass	No	...	Ohio Brass No. 70,756	.....	...	...	Ohio Brass No. 70,756
9	No. 25,620	Ohio Brass	10	No. 25,620	Ohio Brass	No	...	Ohio Brass No. 70,756	.....	...	...	Ohio Brass No. 70,756
9	No. 25,620	Ohio Brass	10	No. 25,620	Ohio Brass	No	...	Ohio Brass No. 70,756	.....	...	...	Ohio Brass No. 70,756
9	No. 25,620	Ohio Brass	10	No. 25,620	Ohio Brass	No	...	Ohio Brass No. 70,756	.....	...	...	Ohio Brass No. 70,756
9	No. 25,620	Ohio Brass	10	No. 25,620	Ohio Brass	No	...	Ohio Brass No. 70,756	.....	...	...	Ohio Brass No. 70,756
9	No. 25,620	Ohio Brass	10	No. 25,620	Ohio Brass	No	...	Ohio Brass No. 70,756	.....	...	...	Ohio Brass No. 70,756
9	No. 25,620	Ohio Brass	10	No. 25,620	Ohio Brass	No	...	Ohio Brass No. 70,756	.....	...	...	Ohio Brass No. 70,756
10	No. 25,620	Ohio Brass	11	No. 25,620	Ohio Brass	No	...	Ohio Brass No. 70,756	.....	...	...	Ohio Brass No. 70,756
9	No. 25,620	Ohio Brass	10	No. 25,620	Ohio Brass	No	...	Ohio Brass No. 70,756	.....	...	...	Ohio Brass No. 70,756
9	No. 25,620	Ohio Brass	10	No. 25,620	Ohio Brass	No	...	Ohio Brass No. 70,756	.....	...	...	Ohio Brass No. 70,756
7—9	No. A-257; No. 25,620	J.-D.; O. B.	8—10	No. A-257; No. 25,620	J.-D.; O. B.	No	...	Ohio Brass No. 70,756	.....	...	...	Ohio Brass No. 70,756
9	No. 25,620	Ohio Brass	10	No. 25,620	Ohio Brass	No	...	Ohio Brass No. 70,756	.....	...	...	Ohio Brass No. 70,756
9	No. 641; No. 5,960	W'hse; Lapp	10	No. 641; No. 5,960	Lapp; W'hse	No	...	W'hse 503,759; O. B. 70,756	.....	...	...	West. No. 503,759; Ohio Brass No. 70,756
4	Suspension Hewlett	Thomas	5	Suspension Hewlett	Thomas	No	...	Yes	.....	...	...	.....
6	Suspension Hewlett	Thomas	7	Suspension Hewlett	Thomas	No	...	Yes	.....	...	...	.....
1	Pin	O. B.; W'hse	1; 6(24)	Pin, suspension	O. B.; W'hse	.....	...	.....	.....	...	...	Tie wire Ohio Brass No. 11,543 on dead-ends and corners
1	Pin	Ohio Brass	1; 6(24)	Pin No. 12,552	Ohio Brass	.....	...	.....	.....	...	...	.....
1	Pin No. 12,552	Ohio Brass	1; 6(24)	Suspension No. 25,622	Ohio Brass	.....	...	.....	.....	...	...	.....
5	Suspension	Lapp; W'hse	6	Suspension	Lapp; W'hse	.....	...	.....	.....	...	...	Lapp No. 5,573
4	Suspension	O. B.; Lapp	5	Suspension	Lapp No. 2,300	.....	...	.....	.....	...	...	Lapp No. 5,573
			7	Suspension No. 2,300	Lapp	.....	...	.....	.....	...	...	Crosby
8	Suspension No. 7,500—T-2	Locke	9	Suspension No. 7,500—G-2	Locke	.....	...	.....	.....	...	...	Locke No. 8,451—G-1
			7	Suspension No. 2,300	Lapp	.....	...	.....	.....	...	...	Crosby
1	Pin	O. B.; W'hse	1; 6(24)	Pin, suspension No. 25,622	O. B.; W'hse	.....	...	.....	.....	...	...	Tie wire Ohio Brass No. 11,543
5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	.....	...	Clamps	.....	...	...	Ohio Brass No. 70,701 with arcing hor. s
1	Pin	Ohio Brass	1; 6(24)	Pin, suspension No. 25,622	Ohio Brass	.....	...	.....	.....	...	...	Tie wire Ohio Brass No. 11,543
5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	.....	...	.....	.....	...	...	Lapp No. 5,573
5	Suspension	Ohio Brass	6	Suspension	Ohio Brass	.....	...	.....	.....	...	...	Ohio Brass No. 70,249
1	Pin	Ohio Brass	2(24)	Pin	Ohio Brass	.....	...	.....	.....	...	...	Tie wire
1	Pin	O. B.; W'hse	1; 6(24)	Pin, suspension No. 26,522	O. B.; W'hse	.....	...	.....	.....	...	...	Tie wire Ohio Brass No. 11,543
8	Suspension No. 25,622	Ohio Brass	9	Suspension No. 25,622	Ohio Brass	.....	...	.....	.....	...	...	Ohio Brass No. 70,249; 11,543
5	Suspension	Ohio Brass	6	Suspension	Ohio Brass	.....	...	.....	.....	...	...	Ohio Brass No. 70,249
1	Pin	Ohio Brass	6(24)	Pin, suspension	Ohio Brass	.....	...	.....	.....	...	...	Tie wire Ohio Brass No. 11,543
1	Pin	Ohio Brass	.....	.....	.....	.....	...	.....	.....	...	...	Tie wire
1	Waconia pin	O. B.; W'hse; La.	1	Waconia pin	O. B.; W'hse; L.	.....	...	.....	.....	...	...	Tie wire
5	Suspension	Ohio Brass	6	Suspension	Ohio Brass	.....	...	.....	.....	...	...	Ohio Brass No. 70,249
5; 1	Suspension, Waconia pin	Ohio Brass	6	Suspension	Ohio Brass	.....	...	.....	.....	...	...	Ohio Brass No. 70,249
3	Pin	Ohio Brass	1; 6(24)	Pin No. 12,552 suspension	Ohio Brass	.....	...	.....	.....	...	...	Tie wire Ohio Brass No. 11,543
4	Suspension	Ohio Brass	5	Suspension	O. B.; Lapp	.....	...	.....	.....	...	...	Ohio Brass No. 70,249
3	Pin	O. B.; W'hse	1; 6(24)	Pin, suspension No. 25,622	O. B.; W'hse	.....	...	.....	.....	...	...	Tie wire Ohio Brass No. 11,543
	Pin	O. B.; W'hse	2(24)	Pin	O. B.; W'hse	.....	...	.....	.....	...	...	Tie wire
5	Suspension	Ohio Brass	6	Suspension	Ohio Brass	.....	...	.....	.....	...	...	Ohio Brass No. 70,249
5	Suspension No. 6,294	Lapp	6	Suspension No. 6,294	Lapp	.....	...	.....	.....	...	...	Lapp No. 5,573
5	Suspension	Ohio Brass	6	Suspension	Ohio Brass	.....	...	.....	.....	...	...	Ohio Brass No. 70,249
8	Suspension	Ohio Brass	9	Suspension	Ohio Brass	.....	...	.....	.....	...	...	Ohio Brass No. 70,249
8	Suspension	Ohio Brass	9	Suspension No. 25,622	Ohio Brass	.....	...	.....	.....	...	...	Ohio Brass No. 73,430
1	Pin	O. B.; W'hse	1; 6(24)	Pin, suspension	O. B.; W'hse	.....	...	.....	.....	...	...	Ohio Brass No. 70,249
												Tie wire Ohio Brass No. 11,543
5	Clevis and pin disc	W'hse; Thomas	6	Clevis and pin disc	W'hse; Thomas	.....	...	.....	.....	...	...	Thomas No. 10,005 and 10,062
5	Hewlett Link	Thomas	6	Hewlett link	Thomas	.....	...	.....	.....	...	...	.....
5	Clevis and pin	Ohio Brass	6	Clevis and pin	Ohio Brass	.....	...	.....	.....	...	...	4-bolt
4	Hewlett Link	Thomas	5	Hewlett link	Thomas	.....	...	.....	.....	...	...	Ohio Brass No. 72,366
4	Cap and Link, cap and pin	O. B.; Thomas	5	Cap and pin; ball socket con.	Ohio Brass	.....	...	.....	.....	...	...	Thomas No. 10,002
5	Cap and pin disc No. 5,800	Locke	6	Cap and pin disc No. 5,800	Locke	.....	...	.....	.....	...	...	Ohio Brass No. 72,366
5	Cap and pin disc No. 57,139	Thomas	6	Cap and pin disc No. 57,139	Thomas	.....	...	.....	.....	...	...	Clevis-3-bolt, .68—.30"
4	Ball socket disc	Ohio Brass	5	Ball socket disc	Ohio Brass	.....	...	.....	.....	...	...	4-bolt
5	Suspension No. 25,622	Ohio Brass	5	Suspension No. 25,622	Ohio Brass	.....	...	.....	.....	...	...	.....
1	Pin No. 7,210	Locke	2 (doubled armed)	Pin No. 7210	Locke	.....	...	.....	.....	...	...	Ohio Brass No. 70,755
5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	.....	...	.....	.....	...	...	.....
1	Pin No. 3,166	Westinghouse	2 (doubled armed)	Pin No. 3166	Westinghouse	.....	...	.....	.....	...	...	Ohio Brass No. 11,538
5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	.....	...	.....	.....	...	...	.....
1	Pin No. 10,748	Ohio Brass	5	Suspension No. 25,622	Ohio Brass	.....	...	.....	.....	...	...	Ohio Brass No. 11,538
5	Suspension No. 25,622	Ohio Brass	5	Suspension No. 25,622	Ohio Brass	.....	...	.....	.....	...	...	.....
1	Pin No. 10,748	Ohio Brass	5	Suspension No. 25,622	Ohio Brass	.....	...	.....	.....	...	...	Ohio Brass No. 70,755
5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	.....	...	.....	.....	...	...	.....
5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	.....	...	.....	.....	...	...	Ohio Brass No. 11,538

53	Bedford—Edwardsport	.....	.....	.....	.....	.....	...	1925	15,000	66	60	Steel towers

	Ohio Brass				Ohio Brass No. 11,538			Sleeve splice		
	Ohio Brass							Cu. sleeve splice	2 oxide film; 3 S. V.	G.E.; W'hse
	Ohio Brass				Ohio Brass No. 70,755			Sleeve splice	3 electrolytic; 1 S. V.	W'hse
	Ohio Brass							Cu. sleeve splice	2 S. V.; 4 el ectrolytic; 3 oxide film	W'hse; G.E.
	Ohio Brass							Sleeve splice	Electrolytic	W'hse
	Ohio Brass				Ohio Brass No. 11,538			Cu. sleeve splice	Oxide film	G. E.
					Ohio Brass No. 11,538			Cu. sleeve splice	Oxide film	G. E.
	Compression joint	Oxide film (at one end)	G. E.	Copper				Through clamp to tower		
	Sleeves	Oxide film	G. E.	Copperweld	⅛	1			Leased wire	19
	Compression joint	Oxide film		Copperweld	7/16	1		Suspension clamp	Radio and leased wire	20
	Sleeves	Oxide film	G. E.	Copperweld	⅛	1		Suspension clamp	Radio and leased lines	21
	Sleeves	Oxide film	G. E.	Copperweld	⅛	1		Suspension clamp	Leased line	22
	Sleeves	Oxide film	G. E.	Copperweld	⅛	1		Suspension clamp	Leased wire	23
	Aluminum double sleeve joint							No. 6 iron	Telephone on part	24
	Lock splice	Oxide film	G. E.	Galvanized steel	5/16	2		None	None	25
	McIntyre sleeves	Oxide film	G. E.	Galvanized steel	5/16	2		Driven pipe	None	26
	McIntyre sleeves	Oxide film	G. E.	Galvanized steel	5/16	1		None	None	27
	McIntyre sleeves	Oxide film	G. E.	Galvanized steel	5/16	1		None	None	28
	McIntyre sleeves	Oxide film	G. E.	Copperweld steel	5/16	1		None	Carrier current	29
	McIntyre sleeves	Oxide film	G. E.	None				Bayonet with ground wire	Telephone	30
643	Twist sleeves	Oxide film	G. E.	High strength steel	5/16	1		No. 2 wire coiled at pole base	Western Electric carrier and Bell telephone	31
m No. 704	Twist sleeves	Oxide film	G. E.	High strength steel	5/16	1		No. 2 wire coiled; 6' pipe	Western Electric carrier and Bell telephone	32
o. 704	Twist sleeves	Oxide film	G. E.	High strength steel	5/16	1		No. 2 wire coiled; 6' pipe	Western Electric carrier and Bell telephone	33
91	Twist sleeves	Oxide film	G. E.	High strength steel	5/16	1			Western Electric carrier and Bell telephone	34
91	Twist sleeves	Oxide film	G. E.	High strength steel	5/16	1		Malone anchors		35
15	Aluminum 2-pc. compression	Oxide	G. E.	Copperweld, high str.	⅛	2		Earth footings	Carrier current	36
41	Twist sleeves	Oxide film	G. E.	High strength steel	5/16	1		Copper wire coiled at base of pole	Bell telephone	37
n No. 704;	Twist sleeves	Oxide film	G. E.	High strength steel	5/16	1		No. 2 wire coiled at base of pole	Western Electric carrier and Bell PBX	38
n No. 704	Twist sleeves	Oxide film	G. E.	High strength steel	5/16	1		No. 2 wire coiled at base of pole	Western Electric carrier and Bell PBX	39
91	Twist sleeves	Oxide film	G. E.	High strength steel	5/16	1		None	Bell telephone PBX	40
91	Twist sleeves	Oxide film	G. E.	High strength steel	5/16	1		None	Bell telephone PBX	41
15	Aluminum 2-pc. compression	Autovalve, oxide film	W'se, G. E.	A.C.S.R.	159,000 c.m.	2		Earth footing	Bell telephone, leased line	42
	Twist sleeves		G. E.	Copperweld strand	7/16	1		Driven iron pipe	Westinghouse carrier current	43
	Twist sleeves		G. E.	None					Westinghouse carrier current	44
	Twist sleeves		G. E.	Cu.-weld str., twrs only	7/16	1		Driven iron pipe	Westinghouse carrier current	45
rica	Twist sleeves	One each end of each circuit;	G. E.	S.-M. steel str.	7/16	1		Clamp to tower	Local exchange	46
	Compression sleeves	oxide film	G. E.	A.C.S.R.	159,000 c.m.	2		Bond to tower	General Electric carrier current	47
	Twist sleeves		G. E.	S.-M. steel str.	7/16	1		Clamp to tower	Westinghouse carrier current	48
	Compression sleeves		G. E.	Cu.-weld, ex-hi-ten str.	½	Each cct. 1		Bound to tower	Westinghouse carrier current	49
	Twist sleeves		G. E.	S.-M. steel str.	7/16	1		Clamp to tower	Westinghouse carrier current	50
	Twist sleeves	3 oxide film	G. E.						Westinghouse carrier current	51
	(14)	(14)	(14)	(14)	(14)	(14)		(14)	(14)	52
	Twist joints								Carrier current	
	Twist joints									
	Twist joints			Aluminum	80,000 c.m.	1		⅛x8 copperweld rod		55
	Twist joints								General Electric carrier current	56
	Twist joints									57
										58
	Twist joints								Carrier current	59
	Twist sleeves	1 oxide film; 1 s. v.	G. E.; W'se	Copperweld strand	7/16	1		Driven iron pipe	Westinghouse carrier current	60
	Twist sleeves	3 oxide film	G. E.						Westinghouse carrier current	61
	Twist sleeves	1 oxide film; 2 s. v.	G. E., W'se	Copperweld strand	7/16	1		Driven iron pipe	Westinghouse carrier current	62
	Twist sleeves	Oxide film (each end)	G. E.						Westinghouse carrier current	63
	Twist sleeves	3 oxide film	G. E.	Copperweld stran	7/16	1		Driven iron pipe	Westinghouse carrier current	64
	Twist sleeves	Oxide film (each end)	G. E.						Westinghouse carrier current	65
90	Hydraulic compression	Oxide film	G. E.	Galvanized steel str.	¼	1(25)		No. 2 cu. at diagonal corners of tower	Carrier current and telephone	66
	Cu. sleeves twisted 4 times	Oxide film	G. E.	Galvanized steel str.	½	1(25)		No. 2 cu. at diagonal corners of tower	Carrier current and telephone	67
	Hydraulic compression	Oxide film	G. E.	Galvanized steel str.	½	1(25)		No. 2 cu. at diagonal corners of tower	Carrier current and telephone	68
	Twist sleeves	Oxide film	G. E.						Westinghouse carrier current	69
	Twist sleeves	Oxide film	G. E.						Westinghouse carrier current	70
	Twist sleeves	Oxide film	G. E.						Westinghouse carrier current	71
	Twist sleeves	Oxide film	G. E.						Westinghousecarrier current	72
	Twist sleeves	Oxide film	G. E.						Westinghouse carrier current	73
	Twist sleeves	Oxide film	G. E.						Westinghouse carrier current	74
11,328	Twist sleeves	Oxide film	G. E.	Siemens-Martin steel	5/16	1		No. 2 cu. spiralled on butt of pole	Wire	75
11,328	Twist sleeves	Oxide film	G. E.	Siemens-Martin steel	5/16	1		No. 2 cu. spiralled on butt of pole	Wire	76
70,231	Compression joint	Oxide film	G. E.	Siemens-Martin steel	⅛	1		Anchors grounded	Wire	77
a 70,231	Twist sleeves	Oxide film	G. E.	Siemens-Martin steel	5/16	1		Anchors grounded	Wire	78
250	Compressed joint	Oxide film	G. E.	Siemens-Martin steel	½	1		Anchors grounded	Wire	79
D 306	Twist sleeves	Oxide film	G. E.; El. Pr. Eq.	A.C.S.R.	5/16	1 and 2(19)		Iron pipe—2 per tower	Carrier current	80
12⅞"	Sleeve compression	Oxide film	G. E.	A.C.S.R.	No. 5/16	1		Sherardised rod	Bell telephone	81
	Sleeve compression	Oxide film	G. E.	Red brass	7/16	2		Sherardised rod	Bell telephone	82
as 73,509	Sleeve compression	Aluminum	G. E.	Copperweld	No. 1/6	1		Cables and rods	Private telephone	83
	Sleeve compression	Oxide film	G. E.	A.C.S.R.	No. 5/16	1		Sherardised rod	Bell telephone	84
, 8"	Sleeves	Autovalve	W'hse					Driven pipe	Westinghouse carrier current	85
	Compression	Oxide film (at terminals)	G. E.			2				86
		Oxide film (at terminals)	G. E.					Each pole has vertical ground wire		87
091	Tw. sl.; compr. sl. for core	Oxide film B. O.	G. E.	A.C.S.R.	134,600	1		2 copperweld rods, 5/16"x10'	A. T. & T. Co. leased line and local Bell	89(a)
756	Tw. sl.; compr. sl. for core	Oxide film B. O.	G. E.	A.C.S.R.	110,000	1		2 copperweld rods, 5/16"x10'	Company owned telephone	89(b)
	Compression	2	G. E.	Aluminum	159,000 c.m.	1			Carrier current 67 K.C.	89(c)
	Twist sleeves	Oxide film B. O.	G. E.	Copperweld (30%)	1/7 strand	1		2 copperweld rods, 5/16"x10'	Company-owned telephone	89(d)
		Oxide film (each end)	G. E.					2/10' 1" galvanised pipe	Bell system	90
No. 70,231	Twist sleeves	Oxide film	G.E.	A.C.S.R.	No. 1/6	1(24)			Company telephone	91
	Twist sleeves			A.C.S.R.	No. 5/16	1(24)			Carrier current telephone	92
	Twist sleeves			A.C.S.R.	No. 5/16	1(24)			Carrier current telephone	93
	Twist sleeves			A.C.S.R.	No. 5/16	1(24)			Carrier current telephone	94
	Twist sleeves			A.C.S.R.	134,560 c.m.	1(24)		2/10' iron pipes on all towers with concrete bases	Carrier current telephone	95
	Twist sleeves			A.C.S.R.	No. 5/16	1(24)			Company telephone	96
	Twist sleeves	Oxide film	G. E.	A.C.S.R.	No. 5/16	1(24)			Company telephone	97
	Twist sleeves			A.C.S.R.	134,560 c.m.	1(24)			Carrier current telephone	98
	Compressor joints			A.C.S.R.	No. 5/16	1(24)			Carrier current telephone	99
	Sleeve compression								Carrier current	100
	Sleeves	Aluminum cell	G. E.						Private telephone; carrier	101
	Sleeves	Oxide film	G. E.						Private telephone; carrier	102
	Twist sleeves	Aluminum cell at ends	G. E.						Private telephone; carrier	103
	Twist sleeves	Aluminum cell at ends	G. E.						Private telephone; carrier	104
	Sleeves	Aluminum cell; ox. film	G. E.						Carrier current	105
	Sleeves	Aluminum cell; ox. film	G. E.						Private telephone	106
	Twist sleeves	Aluminum cell; ox. film	G.E.	Copperweld—7 str.	5/16				Leased wire telephone	107
	Sleeves	Aluminum cell	G.E.						Private telephone	108
	Sleeves	Aluminum cell; ox. film	G.E.						Private telephone	109
	Seamless sleeves	Aluminum cell	G.E.	Copperweld	¾ S.T.	2			2-wire poles, paralleling line	110
	Twist sleeves								None	111
	Twist seamless sleever	Oxide film	G. E.						2-wire, poles paralleling line	112
	Sleeves	Oxide film	G. E.	Copperweld	5/16	1		Driven rod	None	113
	Aluminum sleeves	Oxide film	G. E.	A.C.S.R.	101,790 c.m.	1			Private telephone	114
	Sleeves	Aluminum cell	G. E.	Copperweld	No. 4	1			Private telephone	115
	Compression joint	Aluminum cell	G. E.						Private telephone	116
	Sleeves	Aluminum cell	G. E.	Iron	No. 4	1		Coil under pole butt	Private telephone	117
	Sleeves	Aluminum cell	G. E.						Private telephone	118
										119
	Sleeves	Aluminum cell	G. E.						Private telephone	120
	Sleeves	Aluminum cell	G. E.						Private telephone	121
	Twist sleeves	Aluminum cell	G. E.						None	122
	Twist sleeves	Aluminum cell; oxide film	G. E.						Private telephone	123
	Sleeves	Aluminum cell; oxide film	G. E.						Leased line	
	Twist sleeves	Oxide film	G. E.	Cu.	000	1		Grillage anchor	Telephone on wood poles	124
	Twist sleeves	Oxide film	G. E.	Cu.	000	1		Grillage anchor	Telephone on wood poles	125
	Twist sleeves	Oxide film	G. E.	Cu.	000	1		Grillage anchor	Telephone on wood poles; carrier	126
	Twist sleeves	Oxide film	G. E.	Cu.	000	1		Grillage anchor	Telephone on wood poles	127
	Drawn sleeve	Oxide film	G. E.	Cu.	000	1		Grillage anchor	Telephone on wood poles	128
	Twist sleeves	Oxide film	G. E.	Cu.	000	1		Grillage anchor	Telephone on wood poles; carrier	129
	Twist sleeves	Auto-valve and oxide film	W'hse; G.E.	Cu.	000	1		Grillage anchor	Telephone on wood poles; carrier	130
	Twist sleeves and drawn sleeves	Auto-valve	W'hse	Copperweld	7/16	2		Grillage anchor	Telephone on wood poles; carrier	131
	Twist sleeves	Auto-valve and oxide film	W'hse; G.E.	Cu.	000	1		Grillage anchor	Telephone on wood poles	132
	Twist sleeves	Oxide film	G. E.	Cu.	000	1		Grillage anchor	Telephone on wood poles	133
	Twist sleeves	Oxide film	G. E.	Cu.	000	1		Grillage anchor	Telephone on wood poles; carrier	134
	Twist sleeves	Oxide film	G. E.	Cu.	000	1		Grillage anchor	Telephone on wood poles; carrier	135
0,756	Drawn sleeve	Oxide film	G. E.	Cu.	000	1		Grillage anchor	Telephone on wood poles	136
	Sleeves	Oxide film	G. E.						Carrier, private line	137
	Sleeves	Oxide film	G. E.						Carrier current telephone	138
		Oxide film	G. E.	Siemens-Martin steel	¼	1		¼" S.-M.	Bell	139
	Sleeves	Oxide film	G. E.	Siemens-Martin steel	7/16	1		No. 6 Cu.	Bell and private	140
	Sleeve			Siemens-Martin steel	7/16	1		No. 6 W. P.	Bell and private	141
	Sleeve	Oxide film	G. E.	Siemens-Martin steel	7/16	1		No. 4 iron	Bell and private	142
	Sleeve	Electrolytic; oxide film	G. E.	Siemens-Martin steel	7/16	1		No. 6 solid iron	Bell and private	143
	Sleeve	Oxide film	G. E.					No. 4 solid iron	Bell and private	144
	Sleeve	Oxide film	G. E.	Siemens-Martin steel	5/16	1			Bell and private	145
	Sleeve	Oxide film	G. E.					No. 4 solid iron	Bell and private	146
	Sleeve			Siemens-Martin steel	¼	1		¼" S.-M.	Bell and private	147
or: s	Sleeve	Oxide film; electrolytic	G.E.; W'hse	Siemens-Martin steel	¼	2		¼" S.-M.	Bell and private	148
		Oxide film	G. E.	Siemens-Martin steel	¼	1		¼" messenger	Bell and private	149
	Sleeve			Siemens-Martin steel	7/16	1		No. 6 iron	Bell and private	150
	Sleeve	Oxide film	G. E.	Siemens-Martin steel	7/16	1		7/16" S.-M.	Private	151
	Sleeve	Electrolytic	G. E.	Siemens-Martin steel	¼	1		¼" S.-M.	Bell and private	152
		Oxide film	G. E.	Siemens-Martin steel	¼	1		¼" S.-M.	Bell and private	153
	Sleeve	Oxide film	G. E.	Siemens-Martin steel	½	1			Bell and private	154
	Sleeve	Oxide film	G. E.						Bell	155
		Oxide film	G. E.	Siemens-Martin steel	5/16	1		No. 6 W. P.	Bell and private	156
	Sleeve	Oxide film	G. E.	Iron	No. 4	1			Bell and private	157
	Sleeve	Electrolytic; oxide film	G. E.	Iron	No. 4 solid	1			Private	158
	Sleeve	Electrolytic	G. E.	Siemens-Martin steel	¼	1		¼" S.-M.	Bell and private	159
	Sleeve	Electrolytic	W'hse	Siemens-Martin steel	7/16	1		No. 6 Cu. on pole line	Bell and private	160
	Sleeve	Oxide film	G. E.	Siemens-Martin steel	7/16	1		No. 6 W. P.	Bell and private	161
	Sleeve	Oxide film	G. E.	Siemens-Martin steel	7/16	1		No. 4 galvanised	Bell and private	162
	Sleeve	Oxide film	G. E.	Siemens-Martin steel	7/16	1		No. 6 Cu.	Bell	163
	Sleeve			Siemens-Martin steel	7/16	1		No. 6 Cu.	Bell	164
	Sleeve			Siemens-Martin steel	7/16	1		No. 6 W. P.	Bell	165
	Sleeve			Siemens-Martin steel	7/16	1		No. 6 W. P.	None	166
	Sleeve	Oxide film	G. E.	Siemens-Martin steel	⅛	1		No. 6 W. P.	Bell and private	167
	Sleeve	Oxide film	G. E.	Siemens-Martin steel	7/16	1		7/16" S.-M.	Private and Bell	168
	Sleeve	Oxide film	G. E.	Siemens-Martin steel	5/16	2		No. 6 W. P.	Private and Bell	169
	Sleeve	Oxide film	G. E.	Siemens-Martin steel	5/16	1			Private and Bell	170
	Sleeve	Oxide film	G. E.	Siemens-Martin steel	7/16	1		No. 6 Cu.	None	171
	Twist sleeve	Oxide film	G. E.						Leased telephone	172
	Twist sleeve	Oxide film	G. E.						Leased telephone	173
	Twist sleeve	Oxide film	G. E.	Steel strand	7/16	1			Leased telephone; carrier	174
	McIntyre sleeve No. 527	Oxide film	G. E.						Leased telephone	175
	Double barrel twist sleeve	Aluminum cell; oxide film	G. E.	Steel strand	5/16	2			Private telephone	176
	McIntyre sleeve No. 527	Oxide film	G. E.						Leased telephone	177
	3-section sleeve	Oxide film	G. E.						Carrier	178
	Double barrel twist sleeve	Oxide film; auto-valve	G.E.; W'hse	Steel strand	5/16	2			Private telephone on leased pin space	
	Cu. sleeve splice	1 e'lytic; 1 auto-valve; 2 ox. film	G.E.; W'hse	Galv. steel strand	5/16	2		Galvanised angle	None along line	179
	Sleeve splice	S. V. auto-valve	W'hse					Pipe ground	None along line	180
	Sleeve splice	S. V. auto-valve	W'hse						Two wire system	181
	Sleeve splice	Oxide film	G. E.					Pipe ground	None along line	182
	Cu. sleeve splice	2 oxide film; 3 S. V.	G.E.; W'hse						None along line	183
	Sleeve splice	3 electrolytic; 1 S. V.	W'hse					Pipe ground	None along line	184
	Cu. sleeve splice	2 S. V.; 4 el ectrolytic; 3 oxide film	W'hse; G.E.	Galv. steel strand	5/16	2		Galvanised angle	None along line	185
	Sleeve splice	Electrolytic	W'hse					Pipe ground	Two wire, none along line	186
	Cu. sleeve splice	Oxide film	G. E.						None along line	187
									None along line	188
										189

	Pin No. 10,748	Ohio Brass	5	Suspension No. 25,622	Ohio Brass				
1	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass				
5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass				Ohio Brass No. 11,536
53	Bedford—Edwardsport	1925	15,000	66	60	Steel towers	2	42.4	
54	Connersville—New Castle	1926	6,000	66	60	Wood poles	1	28.2	
55	Connersville—Ohio State Line	1924	4,000	66	60	Wood poles	1	20.4	
56	Jeffersonville—Scottsburg	1925	5,000	66	60	Steel towers	1	29.7	
57	Knightstown—New Castle	1925	10,000	66	60	Wood poles	1	14.9	
58	New Castle—Henry County Line	1928	.....	66	60	Wood poles	1	15.8	
59	Scottsburg—Bedford	1924	5,000	66	60	Wood poles	1	42.6	
	Northern Indiana Power Co.								
60	Converse—Indiana General Service Connection	1928	4,000	66	60	Wood poles	1	5.6	
61	Kokomo—La Fayette	1925	6,000	66	60	Wood poles	1	42.7	
62	Kokomo—Wabash	1928	6,000	66	60	Wood poles	1	36.63	
63	Lenore (Indianapolis)—Noblesville	1925	6,000	66	60	Wood poles	1	34.08	
64	Noblesville—Kokomo	1925	6,000	66	60	Wood poles	1	39.26	
65	Noblesville to Madison—Henry County Line	1928	6,000	66	60	Wood poles	1	30.8	
	Northern Indiana Public Service Co.								
66	Astna—Michigan City	1926	50,000	132	60	Steel towers	1 (16)	23.0	
67	Indiana—Illinois State Line to Astna	1924 and 1925	50,000	132	60	Steel towers	1 (16)	13.8	
68	Michigan City—New Carlisle	1926	50,000	132	60	Steel towers	1 (16)	22.75	
	Wabash Valley Electric Co.								
69	Attica Loop	1925	6,000	66	60	Wood poles	2	6.11	
70	Attica Loop Junction—La Fayette	1925	6,000	66	60	Wood poles	1	18.89	
71	Clinton—Covington Double Circuit Junction	1925	6,000	66	60	Wood poles	1	35.94	
72	Covington—Attica Loop Junction	1925	6,000	66	60	Wood poles	1	27.60	
73	Covington Double Circuit Junction—State Line	1927	6,000	66	60	Wood poles	1	6.45	
74	Double Circuit Junction—Covington	1923 and 1927 (16)	6,000	66	60	Wood poles	2	2.93	
	Central Illinois Public Service Co.								
75	Grand Tower—Mound City	1928	10,000	66	60	Wood poles	1	57.01	
76	Muddy—Effingham	1926	10,000	66	60	Wood poles	1	122.92	
77	Muddy—Shawneetown	1924	20,000	66	60	Steel towers	2	27.18	
78	Muddy—West Frankfort	1922	20,000	66	60	Steel towers	2	24.75	
79	West Frankfort—Grand Tower	1923	50,000	66	60	Steel towers	2	35.69	
	Commonwealth Edison Co.								
80	Calumet Station—108th St., Chicago—Chicago Heights—108th St., Chicago, Ill.—Astna, Ind. (17)	1925	.....	132	60	Steel towers	2	3.8	
	East St. Louis Light & Power Co.								
81	Cahokia—Centerville—(Belleville)	1927	30,000	66	60	Steel towers	2	5	
82	Cahokia—Venice	1927	50,000	66	60	Steel towers	2	4.8	
83	Lake Avenue Substation—Alton	1915	12,000	66	25	Steel towers	1	24	
84	Venice—Alton	1927	24,000	66	60	Steel towers	2	16.56	
85	Peoria—Springfield	1925	30,000	66	60	Steel towers	1 (19)	63	
	Illinois Northern Utilities Co.								
86	Belvidere, Ill.—Beloit, Wis	1927	10,000	66(20)	60	Wood poles	1	20	
87	Belvidere—Crystal Lake	1929	50,000	132	60	Steel towers	1 (19)	22	
88	Dixon—Belvidere	1928	50,000	132	60	Wood poles	1	52	
	Illinois Power & Light Corp.								
89(a)	Belleville—Cahokia Power Plant	1927	15,000	66	60	Steel towers	2	12.6 (21)	
89(b)	Edwardsville—Staunton	1929	5,000	66	60	Steel towers	2	21.6	
89(c)	Kewanee—Seneca	1928	.....	132	60	Steel towers	1	60	
89(d)	Venice Plant—Edwardsville	1923	25,000	66	60	Steel towers	2	16	
	People's Power Co.								
90	Fourth Street Station, Moline, Ill.—Riverside Station, 7½ miles East of Davenport, Iowa	1925	30,000	66	60	Steel towers	2	5.33	
	Public Service Co. of Northern Illinois								
91	No. 5334: Bellwood substation No. 94 to Chicago City Limits	1928	60,000	66	60	Both	1 (22)	1.97 T., 1.37 P	
92	No. 6581: Chicago Heights, D. C. No. 93 to Chicago City Limits	1925	22,800	132	60	Steel towers	2 (23)	10.611	
93	No. 6582: Chicago Heights, D. C. No. 93 to Chicago City Limits	1925	34,300	132	60	Steel towers	2 (23)	13.12	
94	No. 1901: Joliet Station No. 9—Chicago Heights, D. C. No. 93	1925	68,500	132	60	Steel towers	1 (22)	29.744	
95	No. 1903: Joliet Station No. 9—Seneca	1928	34,300	132	60	Steel towers	1 (22)	36.85	
96	No. 1601: Waukegan Station No. 6—Chicago City Limits	1924 and 1927 (24)	68,500	132	60	Steel towers	2 (27)	51.13	
97	No. 1602: Waukegan Station No. 6—Evanston Substation No. 88	1927	30,000	132	60	Steel towers	2 (27)	27.47	
98	No. 1607: Waukegan Station No. 6—Electric Junction Substation No. 111	1928	60,000	132	60	Steel towers	1 (28)	61.76	
99	No. 1603: Waukegan Station No. 6—Wisconsin—Illinois State Line	1927	68,500	132	60	Steel towers	1 (28)	11.45	
	Union Electric Light & Power Co. of Illinois								
100	Cahokia—Crystal City	1925	40,000	110	60	Steel towers	2	30.8	
	Consumers Power Co.								
101	Argenta—Battle Creek	1920	.....	140	30	Steel towers	2	26.1	
102	Battle Creek—Jackson	.....	.....	140	60	Steel towers	1	44.30	
103	Croton Dam—Grand Rapids	1907	.....	75	30	Steel towers	1	42.75	
104	Croton—Muskegon—Newaygo Spur	.....	.....	75	30	Steel towers	1	36.3	
105	Edenville—Saginaw River	1924	.....	140	60	Steel towers	2	39.70	
106	Flint—Battle Creek	1912	.....	140	60	Steel towers	1	112.30	
107	Flint—Saginaw River	1925	.....	140	60	Steel towers	2	43.8	
108	Foote Spur	1917	.....	140	60	Steel towers	1	4.6	
109	Grand Rapids—Kalamazoo	1916	.....	140	30	Steel towers	2	46.2	
110	Grand Rapids—Muskegon	1928	.....	140	30	Steel towers	1	59	
111	Haslett—Millette (Belt Line)	1928	.....	140	60	Steel towers	2	20	
112	Hodenpyl Dam—Junction Dam	1924	.....	140	30	Steel towers	1	10.5	
113	Jackson—Cement City	1928	.....	140	60	Steel towers	1	17.23	
114	Jackson—Lansing	1928	.....	140	60	Steel towers	1	37.843	
115	Junction Dam—Grand Rapids	1918	.....	140	30	Steel towers	2	101.12	
116	Kalamazoo Battle Creek	1926	.....	140	60	Steel towers	1	33.33	
117	Kent City—Muskegon	1907	.....	75	30	Wood poles	1	25.50	
118	Loud—Cooke—Saginaw River	1912	.....	140	60	Steel towers	1	94.58	
119	Loud—Emery Junction	1917	.....	140	60	Steel towers	1	18.5	
120	Mio—Loud	1916	.....	140	60	Steel towers	1	30.5	
121	Newaygo—Fremont	.....	.....	75	30	Wood poles	1	9.3	
122	Rogers Dam—Grand Rapids	.....	.....	75	30	Wood poles	1	53.8	
123	Saginaw River—Flint (old)	1912	.....	140	60	Steel towers	1	37.93	
	The Detroit Edison Co.								
124	Brownstown—Monroe	1925	50,000 (29)	120	60	Steel towers	2	16.1	
125	Brownstown—Navarre	1924	50,000 (29)	120	60	Steel towers	2	14.0	
126	Brownstown—Superior	1924	50,000(29)	120	60	Steel towers	2	25.8	
127	Bloomfield—Shelby	1923	50,000 (29)	120	60	Steel towers	2	13.3	
128	Marysville—Northeast	1928	50,000 (29)	120	60	Steel towers	1	55.5	
129	Shelby—Marysville	1923	50,000 (29)	120	60	Steel towers	2	38.1	
130	Shelby—Northeast	1926	50,000 (29)	120	60	Steel towers	2	18.1	
131	Superior—Blackstone (Interconnection)	1928	50,000 (29)	132	60	Steel towers	1	64	
132	Superior—Bloomfield	1924	50,000 (29)	120	60	Steel towers	2	35.5	
133	Trenton Channel—Brownstown	1924	50,000 (29)	120	60	Steel towers	2	3.6	
134	Trenton Channel—Navarre	1926	50,000 (29)	120	60	Steel towers	2	17.4	
135	Trenton Channel—Warren	1925	50,000 (29)	120	60	Steel towers	2	18.9	
136	Trenton Channel—Warren	(31)	50,000 (29)	120	60	Steel towers	2	17.3	
	Lake Superior District Power Co.								
137	Ashland—Ironwood	1922	12,000	66	60	Wood poles	1	43.3	
138	Ironwood—Big Falls	1922	10,000	88	60	Steel towers	1	86.76	
	Northern States Power Co. of Wisconsin								
139	Alma Center—Blair	1919—1920	.....	69	60	Wood poles	1 (32)	23.82	
140	Alma Center—Sparta	1921	.....	69	60	Wood poles	1	44.1	
141	Cashton Junction—Cashton	1920	.....	69	60	Wood poles	1 (32)	1.5	
142	Cedar Falls—Dells	1909—1928 (25)	.....	69	60	Wood poles	1	23.35	
143	Cedar Falls—Menomonie	1914—1927 (26)	.....	69	60	Wood poles	1	4.4	
144	Chippewa Falls to Junction with Wissota—Eau Claire	1928	.....	69	60	Wood poles	1 (26)	225	
145	Chippewa Falls Hydro—Wissota	1928	.....	120	60	Steel towers	1	2.86	
146	Chippewa Falls Hydro—Wissota to Eau Claire Line	1928	.....	69	60	Wood poles	1	241	
147	Cotton School—Humbird	1919—1920	.....	69	60	Wood poles	1	6.07	
148	Eau Claire—Mondovi—Wabasha	1917	.....	69	60	Wood poles (27)	1	44.91	
149	First Crossing—Cotton School—Neillsville	1915	.....	69	60	Wood poles	1	51.92	
150	First Crossing—Dells Substation No. 2 Line	1912—1928 (25)	.....	69	60	Wood poles	1	2.12	
151	First Crossing—No. 1 Line Madison Street Eau Claire	1919	.....	69	60	.....	1	3	
152	Herbert—Prescott	1914	.....	69	60	Wood poles	1	22.7	
153	Humbird—Alma Center	1919—1920	.....	69	60	Wood poles	1 (32)	7.4	
154	Jim Falls—Wissota	1923	.....	120	60	Steel towers	2	9.91	
155	Lake City—Red Wing—Wabasha Line	1914	.....	69	60	Steel towers	1	93	
156	La Crosse—Junction with Sparta—Viroqua Line	1920	.....	69	60	Wood poles	1	24.33 (30)	
157	Madison Street Substation, Eau Claire—Dells	1912	.....	69	60	Steel towers	2 (39)	88	
158	Menomonie—Red Wing	1912	.....	69	60	376 S.T.; 40 W.P.	1	37.8	
159	Nelson—Cochrane	1917	.....	69	60	Wood poles	1	15.3	
160	Red Wing—Wabasha	1913	.....	69	60	294 S.T.; 16 W.P.	1	30.36 (40)	
161	Sparta—Viroqua	1920	.....	69	60	Wood poles	(41)	31.6	
162	T Corners—Neillsville	1927	.....	69	60	Wood poles	1	36.5 (42)	
163	Thorp Junction—T Corners	1920	.....	69	60	Wood poles	(42)	27.55	
164	Thorp Junction—Thorp	1916	.....	69	60	Wood poles	1	1	
165	Westby Junction—Westby	1920	.....	69	60	Wood poles	1	1.5	
166	Wissota—First Crossing No. 1	1923	.....	69	60	Wood poles	.....	10.4	
167	Wissota—First Crossing No. 2	1912	.....	69	60	Wood poles	1	10.4	
168	Wissota—South St. Paul	1924	.....	120	60	10 S.T.; 750 W.P.	1	77.30	
169	Wissota—Stillwater	1916	.....	120	60	Steel towers	1	75.5	
170	Wissota—Thorp Junction	1918	.....	69	60	Wood poles	1	28.83	
	Wisconsin Power & Light Co.								
171	Dane—Fond du Lac	1922	4,000	66	60	Wood poles	1	86.8	
172	Fond du Lac—Ripon	1927	4,000	66	60	Wood poles	1	22.6	
173	Fond du Lac—Sheboygan	1921	4,000	66	60	Wood poles	1	41.6	
174	Janesville—Beloit	1925	5,000	66	60	Wood poles	1	14.5	
175	Kilbourn—Watertown	1908	20,000	66	25	Steel towers	2	67.4	
176	Madison—Janesville	1920	10,000	66	60	Steel towers	2	42.5	
177	Prairie du Sac—Madison	1915	16,000	66	60	Steel towers	2	26.7	
178	Prairie du Sac—Portage	1914	12,000	66	25	Steel towers	2	23.8	
	Wisconsin Public Service Corp.								
179	Bayside Plant—Green Bay	1926 (44)	85,000	66	60	Steel towers	2	10.4	
180	Brillion—Chilton	1920	21,000	66	60	Wood poles	1	14.5	
181	Caldron Falls—High Falls, Plants	1923	77,000	66	60	Wood poles	1	6.65	
182	Chilton—New Holstein	1921	41,000	66	60	Wood poles	1	7.38	
183	Green Bay—Oshkosh	1925	9,700	66	60	Wood poles	1	53.1	
184	Green Bay—Sawyer	1921	5,700	66	60	Wood poles	1	54.14	
185	High Falls Plant—Bayside Plant	1910 (45)	16,400	66	60	Steel towers	2	59.64	
186	Lake Shore Junction—Kewaunee	1921	6,500	66	60	Wood poles	1	4.74	
187	Peshtigo Junction—Peshtigo	1923	97,000	66	60	Wood poles	1	4.0	
188	Pound—Marinette	1922	25,500	66	60	Wood poles	1	19.92	
189	Wrightstown—Brillion	1925	19,000	66	60	Wood poles	1	15.75	
	Wisconsin Valley Electric Co.								
190	Green Bay—Stevens Point	1928	24,000	110	60	Wood poles	1	79.5	

No. of Footnote	No. of Line	
(1)	51	(Conn. Pwr. Co.) R.R
(1)	22	(Buffalo, Niagara & E
(2)	22, 23, 28, 29	(Buffalo, Niagara & E
(3)	23, 24	(Buffalo, Niagara & E
(4)	26	(Buffalo, Niagara & Ea and 141 in. from cent
(5)	27	(Buffalo, Niagara & E
(6)	28	(Buffalo, Niagara & E
(7)	41, 43	(Central Hudson Gas
(8)	41	(Central Hudson Gas 14.6 mi. (Conn. Lt.
(9)	41, 43	(Central Hudson Gas
(10)	48	(Central Hudson Gas
(11)	93	(Philadelphia Elec. Co one insulated for 22 795,000 c.m., spaced
(12)	85, 87	(Philadelphia Elec. Co

Sleeve splice Cu. sleeve splice		Oxide film	G. E.			None along line			180
2,740	10			A.C.S.R.	167,805	84	22	72	300
	17			A.C.S.R.	167,805	84	22	48	300
	15			A.C.S.R.	167,805	84	24	48	350
5,190	7	Double circuit	American Bridge	A.C.S.R.	167,805	96	22	72	750
	17			A.C.S.R.	167,805	84	22	48	200
	17			A.C.S.R.	211,600	84	23	48	300
	17			A.C.S.R.	167,805	84	22	42	300
	35	40 foot W. R. C. poles		7 strand Cu.	105,625	83.88 equiv.	22	30	150
	27	45 foot W. R. C. poles		7 strand Cu.	133,225	83.88 equiv.	25	30	200
	35	40 foot W. R. C. poles		7 strand Cu.	133,225	83.88 equiv.	22	30	150
	35	45 foot W. R. C. poles		7 strand Cu.	133,225	78.24 equiv.	25	30	150
	35	45 foot W. R. C. poles		7 strand Cu.	133,225	83.88 equiv.	25	30	150
	27	45 foot W. R. C. poles		7 strand Cu.	133,225	83.88 equiv.	25	30	200
16,000 Ave.	5.53	Suspension, strain, transposition	Riter-Conley	A.C.S.R. 30 and 7 strand	397,500	160	28	43	1,000
17,200 Ave.	5.53 Ave.	Suspension, strain, transposition	Riter-Conley	19 strand hard drawn Cu.	300,000	160	35	47	700, 1,000
16,500 Ave.	5.54	Suspension, strain, transposition	Riter-Conley	A.C.S.R. 30 and 7 strand	397,500	160	28	43	1,000
	30	45 foot W. R. C. poles		7 strand Cu.	133,225	83.16 equiv.	25	30	175
	27	45 foot W. R. C. poles		7 strand Cu.	133,225	83.88 equiv.	25	30	200
	30	45 foot W. R. C. poles		7 strand Cu.	133,225	83.88 equiv.	25	30	175
	30	45 foot W. R. C. poles		7 strand Cu.	133,225	83.88 equiv.	25	30	175
	21	50 foot W. R. C. poles		7 strand Cu.	133,225	107.16	25	36	250
	30	45 foot W. R. C. poles		7 strand Cu.	133,225	83.16 equiv.	25	30	175
	22			A.C.S.R.	No. 4/0	72 vert.; 120 horiz.	20	34	240
	22			A.C.S.R.	No. 4/0	72 vert.; 120 horiz.	20	34	240
3,550; 5,800; 6,350	7.5	Wide base 4 leg	Aermotor	A.C.S.R.	No. 3/0	84 v.; 158 and 228 h.	20	30	700
3,550; 5,800; 6,350	7.5	Wide base 4 leg	Aermotor	A.C.S.R.	No. 3/0	84 v.; 158 and 228 h.	20	30	700
4,350; 6,785; 8,175	7	Wide base 4 leg	Aermotor	A.C.S.R.	397,500	102 v.; 180 and 252 h.	20	40	750
8,780; 15,945; 17,635	6	Wide base	Riter-Conley	Cu.	300,000	156	25	48	880
5,000	7	Square	Water Bates Steel	A.C.S.R.	No. 4/0	96; 2' offset	24	28	750
8,000	6.25	Square	Riter-Conley	Cu.	350,000	96; 2' offset	50	32	800
5,000	13	A-frame	Riter-Conley	Cu.	No. 1/0	72	25	28	400
5,000	7	Square	Riter-Conley	A.C.S.R.	No. 3/0	96; 2' offset	24	28	660
[illegible]	[illegible]	[illegible]	[illegible]	Cu.	No. 3/0	144	25	48	700
	12 H fixtures	2-50 foot poles with 29 foot X-arm		A.C.S.R.	266,800	168	26	60	450
	6			Cu.	300,000		25	100	880
	12 H fixtures	2-50 foot poles with 29 foot X-arm		A.C.S.R.	266,800	168	26	60	450
4,000; 6,000	9	4 leg self supporting 15 foot square base	Walter Bates Steel	A.C.S.R.	No. 3/0	204 and 240 h.; 96 v.	25	28	660
4,000; 6,000	9	4 leg self supporting 15 foot square base	Walter Bates Steel	A.C.S.R.	No. 3/0	204 and 240 h.; 84 v.	25	28	660
10,000	7	Suspension and strain	Riter-Conley	Aluminum	477,000	156	25	108	800
4,500; 7,000	9	Square base, 15 foot	American Bridge	A.C.S.R.	No. 3/0	168 and 204 h.; 84 v.	25	28	660
	7	Square base		A.C.S.R.	336,400	108	Varies	42	1,000
5,330; 7,160; 11,960	11 T, 2 P	Wide base	Blaw-Knox	Cu.	400,000	84	37	36	450 T.; 250 P.
Suspension 8,780;	6	Wide base	Riter-Conley	Cu.	300,000	156	25	48	880
Dead-e d 15,945;	6	Wide base	Riter-Conley	Cu.	300,000	156	25	48	880
90° cor. 17,635	6	Wide base	Riter-Conley	Cu.	300,000	156	25	48	880
8,705; 13,740; 17,465	6	Wide base	Riter-Conley	Cu.	300,000	156	25	48	880
6,125; 16,853	11	Wide base	Lt. Aermo.; h'vy, Kenw'd Br.	Cu.	300,000	156	25	48	500
6,125; 16,853	11	Wide base	Lt. Aermo.; h'vy, Kenw'd Br.	Cu.	300,000	156	25	48	500
8,730; 13,745; 16,195	6	Wide base	Riter-Conley	Cu.	300,000	156	25	48	880
9,040; 14,060; 17,680	6	Wide base	Riter-Conley	A.C.S.R.	477,000	156	25	48	880
6,000; 9,000	6.5	Square	Riter-Conley	A.C.S.R.	300,000	144, 42 offset	29	36	800
3,365	10.43	Rigid 4-post	Aermotor	Cu.	No. 2/0	144	25	48	520
1,940	10.19	Rigid 4-post	Aermotor	Cu.	No. 2/0	144	25	48	600
	11	Rigid 3-post	Aermotor	Cu.	72,670;	156, 96, 168	25	36	500
1,940	10.7	Rigid 3-post KK-71	Aermotor	Cu. h.c.	7 strands, No. 2/0	203, 144, 206	25	48	
4,700	8.7	Rigid 4-post	Aermotor	Cu.	No. 2/0	144	25	48	530
1,940	10.9	Rigid 3-post	Aermotor	Cu.	110,000 and 115,000	204,144,204	25	48	520
4,700	8.0	Rigid 4-post	Aermotor	Cu.	No. 3/0	144	25	48	530
1,940	9.9	Rigid 3-post	Aermotor	Cu.	110,000	204, 144, 206	25	48	520
3,365	10.02	Rigid 4-post	Aermotor	Cu. m.h.d.	110,000	144	25	48	520
4,625	7.5	Rigid 4-post	Aermotor	A.C.S.R.	No. 4/0	222	25	60	765
4,860	10	Rigid 4-post	Aermotor	A.C.S.R.	No. 4/0	144	25	60	660
	10	Rigid 4-post	Blaw-Knox	Cu.	No. 2/0	178.8	22	48	520
6,650	6	Rigid 4-post	Aermotor	Cu.	No. 4/0	200	25	60	990
3,400	8.3	Rigid 4-post	Aermotor	A.C.S.R.	No. 4/0	228.5, 144, 228.5	25	60	765
2,800	10.46	Rigid 4-post	Blaw-Knox	Cu.	110,000	144	25	48	520
2,840	10	Rigid 4-post	Aermotor	A.C.S.R.	No. 4/0	144	25	48	520
	40.6			Cu.	No. 2 solid	89, 62.5, 89	23	24	250
1,940	10.2	Rigid 3-post	Aermotor	Cu.	110,000—115,000	204, 144, 206	25	48	520
1,940	10.4	Rigid 4-post	Aermotor	Cu.	110,000	144	25	48	520
1,940	10	Rigid 3-post	Aermotor	Cu.	115,000	204, 144, 206	25	48	520
				Copperweld	No. 5	64, 64, 84			150
	40			Cu.	66,400	60	25		125
1,940	10	Rigid 3-post KK-71	Aermotor	Cu.	115,000	204, 144, 204	25	48	520
76,000; 12,500	7	Square base 15 feet; 18 feet	American Bridge	Cu.	167,772	120, 120—24 offset	28	42	880
7,600; 12,500 (30)	7—8	Square base 15 feet; 18 feet	American Bridge	Cu.	167,772	120, 120—24 offset	28	42	880
7,600; 12,500 (30)	7	Square base 15 feet; 18 feet	American Bridge	Cu.	167,772	120, 120—24 offset	28	42	880
7,600; 12,500 (30)	7	Square base 15 feet; 18 feet	American Bridge	Cu.	167,772	120, 120—24 offset	28	42	880
8,300; 14,300 (30)	7	Square base 17 feet; 18 feet	American Bridge	Cu.	167,772	144, 132—36 offset	28	48	880
7,600; 12,500 (30)	7	Square base 15 feet; 18 feet	American Bridge	Cu.	167,772	120, 120—24 offset	28	42	880
8,700; 16,500 (30)	7—8	Square base 17 feet; 18 feet	American Bridge	Cu.	167,772	144, 132—36 offset	28	48	880
7,600; 14,200 (30)	6	Square base 17 feet; 20 feet	American Bridge	Cu.	211,600	156, 144—30 offset	30	54	900
7,600; 12,500 (30)	7	Sqaure base 15 feet; 18 feet	American Bridge	Cu.	167,772	120, 120—24 offset	28	42	880
7,600; 12,500 (30)	7—8	Square base 15 feet; 18 feet	American Bridge	Cu.	250,000	120, 120—24 offset	28	42	880
7,600; 12,500 (30)	7—8	Square base 15 feet; 18 feet	American Bridge	Cu.	167,772	120, 120—24 offset	28	42	880
7,600; 12,500 (30)	7—8	Square base 15 feet; 18 feet	American Bridge	Cu.	167,772	120, 120—24 offset	28	42	880
7,725; 9,300 (30)	10—11	Square base 6 feet	American Bridge	Cu.	167,772	132, 120—30 offset	35	48	550
	18			No. 0 Cu., No. 2 aluminum	No. 0; No. 2	84	30	48	300
	9		Aermotor and Blaw-Knox	No. 0 aluminum	No. 0	108	45	72	600
	18.4			Stranded Cu.	No. 4	84, 79, 106	27	33	175
	20			Aluminum	No. 1/0	84, 61, 94	28	30	275
	27.1			Aluminum	No. 1/0	94, 84, 61	28	30	275
	17.6			Stranded Cu.	No. 1 (3 strand No. 6)	90, 73, 106	25	33	300
	19.1			Stranded Cu.	No. 1 (3 strand No. 6)	90, 73, 106	35	33	300
				Copperweld	3/8"	162	50	49% susp; 68½% dead end	
8,440	10	Tangent	Walter Bates Steel	Stranded Cu.	No. 2/0	160	26		500
	24.9			Copperweld	3/8"	162	50		
	13.2			Aluminum	No. 1/0	82, 67, 106	28	41	175
	20			Stranded Cu.	No. 2	84, 73, 97 on △	24	36	400
	17.6			Aluminum	No. 1/0	84, 94, 61	28	30	275
	24			Stranded Cu.	No. 1 (3 strand No. 6)	90, 73, 106	25	33	300
	24.2			Stranded Cu.	No. 2/0	84, 94, 61	30	30	220
	44.9			Aluminum	No. 4	72, 72, 72	24.5	24	200
	8.7	Double circuit 50 foot Aermotor	Aermotor	Stranded Cu.	No. 1/0	82, 67, 106	28	41	175
Min. 1,670; max. 2,375	10	3 leg	Aermotor	Stranded Cu.	No. 2/0	174, 210, 174	40	63	550—600
(38)	27.1			Aluminum	No. 2	108, 191, 191	41.5	66	500
2,400	13	Truscon double circuit	Minneapolis Steel & Machine	3 No. 2 str. and 3 No. 2 solid	No. 1/0	94, 84, 61	28	30	250—300
40 foot 1,150; 50 foot sp'l 2,800	11	3-post	Aermotor	Solid Cu.	No. 2	102, 126, 102, 54	32 feet 6 in.	4.25	400
	18			Solid Cu.	No. 4	72, 62, 90	40	30	500
(40) Min. 40 ft. 1,150; max. 100 ft. 7,10 0	10.2	3 leg	Aermotor	Stranded Cu.	No. 2	78, 78	30	39	300
	27.1			Aluminum	No. 2	108, 191, 191	6 in.	66	500
(43)	18			Stranded Cu.	No. 1/0	94, 84, 61	28	30	275
	21.1			Aluminum	3 strand No. 6	114, 76, 115	39	33	300
	21.1			Stranded Cu.	No. 1/0	84, 61, 94	28	30	250
	27.1			Aluminum	No. 2	84, 61, 94	28	30	250
	18			Stranded Cu.	No. 1/0	84, 61, 94	28	30	275
	24			Stranded Cu.	No. 4/0	110, 84, 72	29	42	300
	9.8			Aluminum cable	No. 2/0	84, 61, 94	33	30	220
	7.6		Aermotor	Stranded Cu.	No. 4/0	150, 150	33	72	600
	21.1			Stranded Cu.	No. 2/0	126, 173, 182	36	58	650
					No. 2	84, 61, 94	28	30	250
	20			Str. Cu. 50 mi. A.C.S.R. 36.8	Cu. 83,694, Al. 133,079	72	23	44	250
	20			A.C.S.R.	133,220	72	23	48	265
	20 for 25 100 for 17			Strand Cu.	66,358	60	23	36	250, 100
	8	Wood H-frame		A.C.S.R.	211,600	120	23	72	660
4,000; 6,000	10	4-leg	Aermotor	Str. Cu. hemp core	105,500	72	20	45.5	525
3,500; 4,200	8	4-cornered	Aermotor	A.C.S.R.	211,600	72	27	48	660
4,000; 7,000	11	4-cornered	American Bridge	Aluminum	133,220	78	27	48	480
4,000; 6,000	8	4-post	American Bridge	Stranded Cu.	105,500	72	20	48	650
	10	Rigid	Aermotor	7 str. h.d. Cu.	105,500 and 133,100 (4 mi.)	72	24		500
	28			A.C.S.R.	66,373	72		31	200
	14	Wood H-frame		7 str. h.d. Cu.	105,500	102	33	51	400
	28			A.C.S.R.	66,373	72		31	200
	15	Wood H-frame		7 str. m.h.d. Cu.	105,500	102	33	51	400
	28			A.C.S.R.	66,373	72	32	32	200
	10	Rigid	Aermotor	7 str. h.d. Cu.	105,500 and 133,100 (4 mi.)	72	24	32	500
	31			A.C.S.R.	66,373	72	32	32	200
	27	Wood H-frame		7 strand m.h.d. Cu.	66,370	102	30	51	300
	14	Wood H-frame		7 strand m.h.d. Cu.	105,500	102	33	51	400
	36			Stranded h.d. Cu.	41,740	78		21 Ridge pin	150
	10	H-fixture		Cu.	No. 2/0	156	28	72	Varies

NEW ENGLAND

.) R.R. crossing towers: also one leg gr. with 2x2' No. 14 cu. plate in charcoal; other three have No. 2/0 coil under concrete footing

MIDDLE ATLANTIC

ra & Eastern Pwr. Corp.) 1923 at 60 kv., 25 cyc., 1928 at 110 kv., 60 cyc.
ra & Eastern Pwr. Corp.) One 60 kv., 25 cyc.; two 110 kv., 60 cyc.
ra & Eastern Pwr. Corp.) 1926 at 60 kv., 25 cyc.; 1928 at 110 kv., 60 cyc.
ra & Eastern Pwr. Corp.) Two wires on top, cross-arm 210 in. hor., and third wire on middle cross-arm; 111 in. below top cross-arm om center line of tower.
ra & Eastern Pwr. Corp.) 1906 at 60 kv., 25 cyc.; 1928 at 110 kv., 60 cyc.
ra & Eastern Pwr. Corp.) 1923 at 60 kv., 25 cyc.; 1928 at 110 kv., 60 cyc.
on Gas & Elec. Corp.) Operated at 66 kv.
on Gas & Elec. Corp.) 1.3 mi. R.R. towers and S.P.; 3.7 mi. special susp. and anchor towers. 17.4 std. susp. and anchor towers.
un. Lt. & Pwr. Co.) also special R.R. crossing tower.
on Gas & Elec. Corp.) Exclusive of footings.
on Gas & Elec. Corp.) Operated at 33 kv.
Elec. Co.) Plymouth Meeting—Trenton Cut off. Designed for two 66 kv. and one 220 kv. circuit present installation: one 66 kv.; l for 220 but operated at 66 kv. Conductors of former are 636,000 c.m. spaced 132 and 147 inches; tower clearance 42 in. latter, spaced 306 in., clearance 96 inches.
Elec. Co.) Tower spacing for 132 kv.

No. of Footnote	No. of Line
(1)	2
(2)	2
(3)	3
(4)	9a
(5)	10
(6)	19
(7)	22, 23
(8)	34, 40, 41
(9)	37
(10)	43
(11)	48
(12)	49
(13)	49
(14)	52
(15)	66, 67, 68
(16)	74
(17)	80
(18)	80

EAST NORTH CENTRAL

(Dayton Pwr. & L. Co.) This line continues with two single circuit wood-pole lines. The stee
(Dayton Pwr. & Lt. Co.) High strength steel except copper-clad on R.R. crossings and R.R.
(Dayon Pwr. & Lt. Co.) This line continues on double circuit steel tower line in the outskirts
(Ohio Public Service Co.) Old rating of pin type inulators 55 kv. Line has been operating at
(Ohio Public Service Co.) 31.9 Ohio Public Service Co.; 14.8 Toledo Edison Co.
(Pennsylvania Ohio Pwr. & Lt. Co.) Built for 132 kv.
(Pennsylvania Ohio Pwr. & Lt. Co.) Tower 1 to 184 has two circuits 271 and 272.
(Union Gas & Elec. Co.) Two units normally spanned by fuse.
(Union Gas & Elec. Co.) This line connects at Contreas with Interstate Public Service Co.'s lin
(Indiana Elec. Corp.) Many steel towers used in rough country and spaced according to topo Dresser 132 kv. line.
(Indiana Elec. Corp.) Old section.
(Indiana Elec. Corp.) New section.
(Indiana Elec. Corp.) Two for 18.3 miles, one for 58.44.
(Indiana Elec. Corp.) See Lenore—Columbia lines above, this is the short circuit on the L.
(Northern Indiana Public Service Co.) Ultimate 2. Approximately dry flashover. Space for
(Wabash Valley Elec. Co.) 1923 as single; 1927 as double.
(Commonwealth Edison Co.) This line continues to Joliet as Public Service Co. of Northern
(Commonwealth Edison Co.) One which because of bends in right-of-way goes from one side line outside of city has 2.

84	22	72	500	5.17	1,200						
84	22	48	300	2.33	1,200	Horizontal	75,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,6
84	24	48	350	3.75	1,200	Horizontal	75,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,6
96	22	72	750	16	1,300	Vertical	90,000	6	Suspension No. 25,622	Ohio Brass	7	Suspension No. 25,6
84	22	48	200	2.33	1,200	Horizontal	75,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,6
84	23	48	300	2.33	1,200	Horizontal	75,000	5	Suspension	Westinghouse	6	Suspension
84	22	42	300	2.33	1,200	Horizontal	75,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,6
83.88 equiv.	22	30	150	1.5	750	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspensi
83.88 equiv.	25	30	200	2.08	950	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspensi
83.88 equiv.	22	30	150	1.5	750	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspensi
78.24 equiv.	25	30	150	1.5	750	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspensi
83.88 equiv.	25	30	150	1.5	750	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspensi
83.80 equiv.	25	30	200	2.08	950	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspensi
160	28	43	1,000	26.25	2,950	Vertical	550,000[33]	8 and 9	Jeffery-Dewitt A-257	Jeffery-Dewitt	8 and 9[34]	Jeffery-Dewitt A-2
160	35	47	700, 1,000	18.84, 38.45	2,975	Vertical	550,000[33]	8 and 9	Jeffery-Dewitt A-257	Jeffery-Dewitt	8 and 9[34]	Jeffery-Dewitt A-2
160	28	43	1,000	26.25	2,950	Vertical	550,000[33]	8 and 9	Jeffery-Dewitt A-257	Jeffery-Dewitt	8 and 9[34]	Jeffery-Dewitt A-2
83.16 equiv.	25	30	175	1.83	900	Vertical	66,000	1	Pin	Ohio Brass	6	No. 25622 suspensi
83.88 equiv.	25	30	200	2.08	950	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspensi
83.88 equiv.	25	30	175	1.83	900	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspensi
83.88 equiv.	25	30	175	1.83	900	"L" configuration	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspensi
107.16	25	36	250	2.92	1,050	"L" configuration	66,000	5	Franklin suspension	E. S. supplies	5	Franklin suspensio
83.16 equiv.	25	30	175	1.83	900	Vertical	66,000	1	Pin	Ohio Brass	6	No. 25,622 suspensi
72 vert.; 120 horiz.	20	34	240	1.8	1,200	Vert. and hori.	66,000	5	Hewlett	Thomas	6	Hewlett
72 vert.; 120 horiz.	20	34	240	1.8	1,200	Vert. and hori.	66,000	5	Hewlett	Thomas	6	Hewlett
84 v.; 156 and 228 h.	30	30	700	8.5	1,650	Vertical	66,000	5	Hewlett	Thomas	6	Hewlett
84 v.; 156 and 228 h.	20	30	700	8.5	1,650	Vertical	66,000	5	Hewlett	Locke	6	Hewlett
102 v.; 180 and 252 h.	20	40	750	14	2,500	Vertical	66,000	5	Cem. cap ball and socket	Ohio Brass	6	Cemented cap ball and
156	25	48	880	31	2,920	Vertical	580,000	8	A-257	Jeffery-Dewitt	9	A-257
96; 2° offset	24	28	750	21	4,000	Vertical	70,000	6	No. 25,622	Ohio Brass	7	No. 25,622
96; 2° offset	50	32	800	24	7,400	Vertical	70,000	7	No. 2,094 and No. 5,960	Lapp	8	No. 2,094 and 5,96
72	25	28	400	12	3,000	Vertical	70,000	6	No. 25,620	Ohio Brass	8	No. 25,620
96; 2° offset	24	28	660	26	3,000	Vertical	70,000	6	No. 5,960	Lapp	7	No. 5,960
144	25	48	700	10.5	1,635	Vertical	154,000	10 (11 top)	Suspension	Ohio Brass	12	Strain
168	26	60	450	5.5	1,500	Horizontal		4[30]		Jeffery-Dewitt	5	
	25	100	880	31	2,950	Vertical		8	Jeffery-Dewitt	Jeffery-Dewitt	9	Jeffery-Dewitt
168	26	60	450	5.5	1,500	Horizontal		10	Cap and pin	Locke	11	Cap and pin
204 and 240 h.; 96 v.	25	28	660	14	1,160	Vertical	[22]	7	B. & S. suspension No. 18,400	Locke	8	B. & S. suspension No.
204 and 240 h.; 84 v.	25	28	660	15.5	810	Vertical	[22]	7	B. & S. suspension No. 18,400	Locke	8	B. & S. suspension No.
156	25	108	800		9,000	Vert. and hori.	132,000	11	No. 25,620	Ohio Brass	22	No. 25,622
168 and 204 h.; 84 v.	25	28	660	15.5	810	Vertical	[22]	7	B. & S. suspension No. 18,400	Locke	8	B. & S. suspension No
108	Varies	42	1,000	12	6,300	Vertical	75,000	5	Suspension	W'hse No. 601	6	Suspension
84	37	36	450 T.; 250 P.	11.8 T.; 5.7 P.	2,625 T.; 1,700 P.	V. towers; △ poles	390,000	5	Jeffery-Dewitt	Jeffery-Dewitt	5	High strength
156	25	48	880	31	2,920	Vertical	580,000	8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspe
156	25	48	880	31	2,920	Vertical	580,000	8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspe
156	25	48	880	31	2,920	Vertical	580,000	8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspe
156	25	48	880	31	2,920	Vertical	580,000	8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspe
156	25	48	500	11	3,100	Vertical	580,000	8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspe
156	25	48	500	11	3,100	Vertical	580,000	8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspe
156	25	48	880	31	2,920	Vertical	580,000	8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspe
156	25	48	880	30.5	2,025	Vertical	580,000	8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspe
144, 42 offset	29	36	800	17	6,000	Vertical	132,000	10 per string	No. 25,622	Ohio Brass	20 to 53	No. 25,622
144	25	48	520	13'9"	922	Vertical	460,000	10	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,6
144	25	48	600	14	1,050	△	460,000	10	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,6
156, 96, 168	25	36	500	15	776	△	350,000	7	Ohio Brass No. 25,622	Ohio Brass	8	Ohio Brass No. 25,6
203, 144, 206	25	48				△	350,000	7	Suspension No. 10,566	Ohio Brass	8	Suspension No. 10,5
144	25	48	530	11	1,638	Vertical	425,000	9	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,6
204, 144, 204	25	48	520	13'9"	922	△	460,000	10	Susp. No. 10,566; 12,464; 25,622	Ohio Brass	10—12	Suspension No. 10,566,
144	25	48	530	11	1,635	Vertical	425,000	9	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,6
204, 144, 206	25	48	520	13'9"	922	△	460,000	10	Suspension No. 12,464	Ohio Brass	10—12	Suspension No. 12,4
144	25	48	520	13'9"	922	Vertical	460,000	10	Suspension No. 25,622	Ohio Brass	10—12	Suspension No. 25,6
222	25	60	765	9½	1,490	Horizontal	550,000	10	Suspension No. 29,210	Ohio Brass	11	Suspension No. 29,2
144	25	60	660	16'11"	1,030	Vertical	550,000	10—11	Suspension No. 29,210	Ohio Brass	11—12	Suspension No. 29,2
178.8	22	48	520	13' 9"	922	△	460,000	10	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,6
200	25	60	980	29'10"	2,211	Vertical	460,000	10—11	Suspension No. 25,620	Ohio Brass	11—12	Suspension No. 25,6
228.5, 144, 228.5	25	60	765	16	1,350	Unequal △	460,000	10	Suspension	Ohio Brass	11	Suspension No. 25,6
144	25	48	520	13' 9"	922	Vertical	460,000	10	Suspension No. 25,622	Ohio Brass	10—12	Suspension No. 25,6
144	25	48	520	13' 9"	922	Vertical	460,000	10	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,6
89, 62.5, 89	23	24	250	4	556	△	215,000	1	Pin No. 12,552	Ohio Brass	1	Pin No. 12,552
204, 144, 206	25	48	520	13' 9"	922	△	460,000	10	Susp. No. 10,566; 25,622; 29,219	Ohio Brass	10—12	Suspension No. 10,5
144	25	48	520	13' 9"	922	Vertical	460,000	10	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,6
204, 144, 206	25	48	520	13' 9"	922		460,000	10	Suspension No. 25,622	Ohio Brass	10—12	Suspension No. 25,6
64, 64, 84	25		150	1	242		215,000	1	Pin No. 12,522	Ohio Brass	7	Suspension No. 25,6
60	25		125				215,000	1	Pin	Ohio Brass		
204, 144, 204	25	48	520	13' 9"	922	△	493,000	10	Susp. No. 10,566; No. 25,622	Ohio Brass	12	Suspension No. 12,4
120, 120—24 offset	28	42	880	33.8	1,500	Vertical	120,000	9	No. 25,620	Ohio Brass	10	No. 25,620
120, 120—24 offset	28	42	880	33.8	1,500	Vertical	120,000	9	No. 25,620	Ohio Brass	10	No. 25,620
120, 120—24 offset	28	42	880	33.8	1,500	Vertical	120,000	9	No. 25,620	Ohio Brass	10	No. 25,620
120, 120—24 offset	28	42	880	33.8	1,500	Vertical	120,000	9	No. 25,620	Ohio Brass	10	No. 25,620
144, 132—36 offset	28	48	880	33.8	1,500	Vertical	120,000	9	No. 25,620	Ohio Brass	10	No. 25,620
120, 120—24 offset	28	42	880	33.8	1,500	Vertical	120,000	9	No. 25,620	Ohio Brass	10	No. 25,620
144, 132—36 offset	28	48	880	33.8	1,500	Vertical	120,000	9	No. 25,620	Ohio Brass	10	No. 25,620
156, 144—30 offset	30	54	900	31.2	2,100	Vertical	140,000	10	No. 25,620	Ohio Brass	11	No. 25,620
120, 120—24 offset	28	42	880	33.8	1,500	Vertical	120,000	9	No. 25,620	Ohio Brass	10	No. 25,620
120, 120—24 offset	28	42	880	33.8	2,200	Vertical	120,000	9	No. 25,620	Ohio Brass	10	No. 25,620
120, 120—24 offset	28	42	880	33.8	1,500	Vertical	120,000	7—9	No. A-257; No. 25,620	J.-D.; O. B.	8—10	No. A-257; No. 25,6
120, 120—24 offset	28	42	880	33.8	1,500	Vertical	120,000	9	No. 25,620	Ohio Brass	10	No. 25,620
132, 120—30 offset	35	48	550	17.5	1,100	Vertical	120,000	9	No. 641; No. 5,960	W'hse; Lapp	10	No. 641; No. 5,960
84	30	48	300	Al. Co. specif.	Al. Co. speci.	△	66,000	4	Suspension Hewlett	Thomas	5	Suspension Hewle
108	45	72	600	Al. Co. specif.	Al. Co. speci.		88,000	6	Suspension Hewlett	Thomas	7	Suspension Hewle
84, 79, 106	27	33	175	2.7	210	△	70,000	1	Pin	O. B.; W'hse	1; 6[34]	Pin, suspension
84, 61, 94	28	30	275	2.5	500	△	70,000	1	Pin	Ohio Brass	1; 6[34]	Pin No. 12,552
94, 84, 61	28	30	275	2.5	500	△	70,000	1	Pin No. 12,552	Ohio Brass	1; 6[34]	Suspension No. 25,
90, 73, 106	25	33	300	3.83	700	△	80,000	5	Suspension	Lapp; W'hse	6	Suspension
90, 73, 106	35	33	300	3.83	700	△	80,000	4	Suspension	O. B.; Lapp	5	Suspension
162	50	49⅞a susp;				Horizontal	80,000				7	Suspension No. 2,3
160	26	68⅝a dead	500	18.5	994	Horizontal	160,000	8	Suspension No. 7,500—T-2	Locke	9	Suspension No. 7,500-
162	50	end				Horizontal	80,000				7	Suspension No. 2,3
82, 67, 106	28	41	175	2.5	320	△	70,000	1	Pin	O. B.; W'hse	1; 6[34]	Pin, suspension No.
84, 73, 97 on △	24	36	400	4.3	2,310	Vertical	80,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,
84, 94, 61	28	30	275	2.5	500	△	70,000	1	Pin	Ohio Brass	1; 6[34]	Pin, suspension No.
90, 73, 106	25	33	300	3.83	700	△	80,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,
84, 94, 61	30	30	220	3	1,815	△	80,000	5	Suspension	Ohio Brass	6	Suspension
72, 72, 72	24.5	24	200	2.7	240	△	70,000	1	Pin	Ohio Brass	2[34]	Pin
82, 67, 106	28	41	175	2.5	320	△	70,000	1	Pin	O. B.; W'hse	1; 6[34]	Pin, suspension No.
174, 210, 174	40	63	550—600	12	2,270	Vertical	120,000	8	Suspension No. 25,622	Ohio Brass	9	Suspension No. 25,
108, 191, 191	41.5	66	500	8	785	△	80,000	5	Suspension	Ohio Brass	6	Suspension
94, 84, 61	28	30	250—300	2.5	500	△	66,000	1	Pin	Ohio Brass	6[34]	Pin, suspension
102, 126, 102, 54	32 feet 6 in.	4.25	400	4.5	890, No. 2 solid, 2210 No. 2 str.	Vertical	70,000	1	Pin	Ohio Brass		
72, 62, 90	40	30	500	6.2	660	△	70,000	1	Waconia pin	O. B.; W'hse; La.	1	Waconia pin
78, 78	30	39	300	6.7	336	Horizontal	80,000	5	Suspension	Ohio Brass	6	Suspension
108, 191, 191	6 in.	66	500	8	785	△	80,000	5; 1	Suspension, Waconia pin	Ohio Brass	6	Suspension
94, 84, 61	28	30	275	2.5	500	△	70,000	3	Pin	Ohio Brass	1; 6[34]	Pin No. 12,552 suspen
114, 76, 115	39	33	300	3.83	700	△	80,000	4	Suspension	Ohio Brass	5	Suspension
84, 61, 94	28	30	250	2.67	435	△	70,000	3	Pin	O. B.; W'hse	1; 6[34]	Pin, suspension No. 2
84, 61, 94	28	30	250	4.5	350	△	70,000		Pin	O. B.; W'hse	2[34]	Pin
84, 61, 94	28	30	275	2.5	500	△	80,000	5	Suspension	Ohio Brass	6	Suspension
110, 84, 72	20	42	300	3.7	2,000	△	70,000	5	Suspension No. 6,294	Lapp	6	Suspension No. 6,2
84, 61, 94	33	30	220	3	1,815	△	80,000	5	Suspension	Ohio Brass	6	Suspension
150, 150	33	72	600	18	750	Horizontal	160,000	8	Suspension	Ohio Brass	9	Suspension
126, 173, 182	36	58	650	12.5	1,700	△	160,000	8	Suspension	Ohio Brass	9	Suspension No. 25,
84, 61, 94	28	30	250	4.5	350	△	70,000	1	Pin	O. B.; W'hse	1; 6[34]	Pin, suspension
72	23	44	250	Cu. 2; A.C.S.R. 1.8	Cu. 600; A.C.S.R. 900	Unequal △	66,000	5	Clevis and pin disc	W'hse; Thomas	6	Clevis and pin di
72	23	48	265	1.8	900	Unequal △	66,000	5	Hewlett Link	Thomas	6	Hewlett link
60	23	36	250, 100	3, 0.8		Unequal △	66,000	5	Clevis and pin	Ohio Brass	6	Clevis and pin
120	23	72	660	10.5	1,200	Horizontal	66,000	4	Hewlett Link	Thomas	5	Hewlett link
72	20	45.5	525	14		Vertical	66,000	4	Cap and Link, cap and pin	O. B.; Thomas	5	Cap and pin; ball sock
72	27	48	660	10.5	1,200	Vertical	66,000	5	Cap and pin disc No. 5,800	Locke	6	Cap and pin disc No.
78	27	48	480	8	785	Vertical	66,000	5	Cap and pin disc No. 57,139	Thomas	6	Cap and pin disc No. 5
72	20	48	650	18	800 approx.	Vertical	66,000	4	Ball socket disc	Ohio Brass	5	Ball socket disc
72	24		500	14.4	700	Vertical	66,000	5	Suspension No. 25,622	Ohio Brass	5	Suspension No. 25,6
72		31	200	2	500	△	66,000	1	Pin No. 7,210	Locke	2 (doubled armed)	Pin No. 7210
102	33	51	400	8.5	750	Horizontal	66,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,
72		31	200	2	500	△	66,000	1	Pin No. 3,166	Westinghouse	2 (doubled armed)	Pin No. 3166
102	33	51	400	8.5	750	Horizontal	66,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,
72	32	32	200	2	500	△	66,000	1	Pin No. 10,748	Ohio Brass	5	Suspension No. 25,
72	24	32	500	14.4	700	Vertical	66,000	5	Suspension No. 25,622	Ohio Brass	5	Suspension No. 25,
72	32	32	200	2	500	△	66,000	1	Pin No. 10,748	Ohio Brass	5	Suspension No. 25,
102	30	51	300	6	375	Horizontal	66,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,
102	33	51	400	8.5	750	Horizontal	66,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,
78		21 Ridge pin	150	1.5	300	△	66,000	1	Pin No. 10,748	Ohio Brass	2	Pin No. 10,748, doubl
156	28	72	Varies			Horizontal		8	Suspension No. 2,300	Lapp	9	Suspension

EAST NORTH CENTRAL

Co.) This line continues with two single circuit wood-pole lines. The steel tower position is wihin the outskirts of Dayton.
Co.) High strength steel except copper-clad on R.R. crossings and R.R. parallels.
Co.) This line continues on double circuit steel tower line in the outskirts of Dayton.
Co.) Old rating of pin type inulators 55 kv. Line has been operating at 66 kv. for about 10 years.
Co.) 31.9 Ohio Public Service Co.; 14.8 Toledo Edison Co.
Pwr. & Lt. Co.) Built for 132 kv.
Pwr. & Lt. Co.) Tower 1 to 184 has two circuits 271 and 272.
Co.) Two units normally spanned by fuse.
Co.) This line connects at Contreas with Interstate Public Service Co.'s line feeding Connersville and other towns in Indiana.
Many steel towers used in rough country and spaced according to topography. Tower details same as used for Lefiore—
e.
Old section.
New section.
Two for 18.3 miles, one for 58.44.
See Lenore—Columbia lines above, this is the short circuit on the L.-C. line; built for 132 kv., operated at 66 kv.
ublic Service Co.) Ultimate 2. Approximately dry flashover. Space for second ground wire installed with second circuit
Co.) 1923 as single; 1927 as double.
son Co.) This line continues to Joliet as Public Service Co. of Northern Illinois, which see.
son Co.) One which because of bends in right-of-way goes from one side of tower to the other in many places; remainder of
has 2.

EAST NORTH CENTRAL—Continued

No. of Footnote	No. of Line	
(19)	85, 87	(Illinois Elec. Pwr. Co.) Ultimate 2.
		(Illinois Northern Utilities Co.) Ultimate 2.
(20)	86	(Illinois Northern Utilities) In 1929 this line will be changed to 132 kv. by adding 4 J.-D. units to each
(21)	89a	(Illinois Pwr. & Lt. Corp.) 8.6 miles I. P. & L. Corp. and 4 miles Union Elec. Co. of Ill.
(22)	89a, b, d,	(Illinois Pwr. & Lt. Corp.) 380,000 volts dry flashover, 305,000 volts dry flashover.
(23)	91, 94, 95	(Public Service Co. of Northern Illinois) Two on towers available, one in use, one on poles.
(24)	91—99	(Public Service Co. of Northern Illinois) Over each circuit.
(25)	92, 93	(Public Service Co. of Northern Illinois) Line No. 6581 on same tower line as line No. 6582.
(26)	96	(Public Service Co. of Northern Illinois) To Evanston in 1924, to City limits in 1927.
(27)	96, 97	(Public Service Co. of Northern Illinois) Line No. 1601 on same tower line as line No. 1602.
(28)	98, 99	(Public Service Co. of Northern Illinois) See footnote 19.
(29)	124—136	(The Detroit Edison Co.) Per Circuit.
(30)	124—136	(The Detroit Edison Co.) Anchors included.
(31)	136	(The Detroit Edison Co.) To be connected shortly.
(32)	139	(Northern States Pwr. Co. of Wisconsin) Joint line 1—69 kv. 1—6.9 kv.
(33)	141, 153	(Northern States Pwr. Co. of Wisconsin) 1—69 kv. and 6.9 kv.
(34)	139, 140, 141, 147, 149, 152, 153, 156, 161, 163, 164, 170	(Northern States Pwr. Co. of Wisconsin) On all new pole installations standard construction used, 6 on dead ends and corners (O. B. No. 25,622 susp. used).

No. 25,620	Ohio Brass	No					Ohio Brass No. 70,730	Twist joints					
No. 25,620	Ohio Brass	No					Ohio Brass No. 70,730	Twist joints					
No. 25,620	Ohio Brass	No					Ohio Brass No. 70,730	Twist joints					
sion	Westinghouse	No											
No. 25,620	Ohio Brass	No					Ohio Brass No. 70,730	Twist joints					
spension	Ohio Brass	No					Ohio Brass No. 11,541	Twist sleeves	1 oxide film; 1 s. v.	G. E.; W'se	Copp		
spension	Ohio Brass	No					Ohio Brass No. 11,541	Twist sleeves	3 oxide film	G. E.			
spension	Ohio Brass	No					Ohio Brass No. 11,541	Twist sleeves	1 oxide film; 2 s. v.	G. E., W'se	Copp		
spension	Ohio Brass	No					Ohio Brass No. 11,541	Twist sleeves	Oxide film (each end)	G. E.			
spension	Ohio Brass	No					Ohio Brass No. 11,541	Twist sleeves	3 oxide film	G. E.	Copp		
spension	Ohio Brass	No					Ohio Brass No. 11,541	Twist sleeves	Oxide film (each end)	G. E.			
witt A-257	Jeffery-Dewitt	No		Ohio Brass			Ohio Brass No. 73,179	Hydraulic compression	Oxide film	G. E.	Galva		
witt A-257	Jeffery-Dewitt	No		Jeffery-Dewitt		Oval	Jeffery-Dewitt CH 200 and S 400	Cu. sleeves twisted 4 times	Oxide film	G. E.	Galva		
witt A-257	Jeffery-Dewitt	No		Ohio Brass			Ohio Brass No. 73,179	Hydraulic compression	Oxide film	G. E.	Galva		
spension	Ohio Brass	No					Ohio Brass No. 11,541	Twist sleeves	Oxide film	G. E.			
spension	Ohio Brass	No					Ohio Brass No. 11,541	Twist sleeves	Oxide film	G. E.			
spension	Ohio Brass	No					Ohio Brass No. 11,541	Twist sleeves	Oxide film	G. E.			
spension	Ohio Brass	No					Ohio Brass No. 11,541	Twist sleeves	Oxide film	G. E.			
spension	E. S. supplies	No					Ohio Brass No. 11,541	Twist sleeves	Oxide film	G. E.			
spension	Ohio Brass	No					Ohio Brass No. 11,541	Twist sleeves	Oxide film	G. E.			
lett	Thomas	No		Plain			Thomas No. 10,092; strain Ohio Brass 11,328	Twist sleeves	Oxide film	G. E.	Siem		
lett	Thomas	No		Plain			Thomas No. 10,092; strain Ohio Brass 11,328	Twist sleeves	Oxide film	G. E.	Siem		
lett	Thomas	No		Plain			Thomas No. 5,717 strain Ohio Brass 70,231	Compression joint	Oxide film	G. E.	Siem		
lett	Locke	No		Plain			Thomas 10,092; Locke 3,045; Ohio Brass 70,231	Twist sleeves	Oxide film	G. E.	Siem		
all and socket	Ohio Brass	No		Plain			Ohio Brass Nos. 70,701; 70,249; 70,250	Compressed joint	Oxide film	G. E.	Siem		
57	Jeffery-Dewitt	No					Jeffery-Dewitt C 200; Jeffery-Dewitt D 306	Twist sleeves	Oxide film	G. E.; El. Pr. Eq.			
,622	Ohio Brass	No		Special design			Ohio Brass No. 73,511, 13½"	Sleeve compression	Oxide film	G. E.			
nd 5,960	Lapp	No		Special design			Ohio Brass No. 70,731, 70,231, 9¾", 12¾"	Sleeve compression	Oxide film	G. E.			
,620	Ohio Brass	No					Ohio Brass No. 11,041, 8¼"	Sleeve compression	Aluminum	G. E.	C		
,960	Lapp	No		Special design			Ohio Brass No. 73,037; Ohio Brass 73,589	Sleeve compression	Oxide film	G. E.			
in	Ohio Brass	No		Ohio Brass flux controls			Thomas No. 10,091 suspension, 8"	Sleeves	Autovalve	W'hse			
	Jeffery-Dewitt	No											
Dewitt	Jeffery-Dewitt	No					Locke trunnion	Compression	Oxide film (at terminals)	G. E.			
d pin	Locke	No							Oxide film (at terminals)	G. E.			
ion No. 18,400	Locke			Yes			Ohio Brass No. 70,756 and No. 71,091	Tw. sl.; compr. sl. for core	Oxide film B. O.	G. E.			
ion No. 18,400	Locke			Yes			Ohio Brass No. 72,703 and No. 70,756	Tw. sl.; compr. sl. for core	Oxide film B. O.	G. E.			
,622	Ohio Brass	No					Ohio Brass	Compression	2	G. E.			
ion No. 18,400	Locke			Yes			Locke No. 118 Universal	Twist sleeves	Oxide film B. O.	G. E.	Cop		
sion	W'hse No. 631	No							Oxide film (each end)	G. E.			
rength	Lapp	No					Jeffery-Dewitt C-300; strain Ohio Brass No. 70,231	Twist sleeves	Oxide film	G. E.			
suspension	Jeffery-Dewitt	No					Jeffery-Dewitt C-200; strain D-306	Twist sleeves					
suspension	Jeffery-Dewitt	No					Jeffery-Dewitt C-200; strain D-306	Twist sleeves					
suspension	Jeffery-Dewitt	No					Jeffery-Dewitt C-200; strain D-306	Twist sleeves					
suspension	Jeffery-Dewitt	No					Jeffery-Dewitt C-200; strain D-306	Twist sleeves					
suspension	Jeffery-Dewitt	No				22	Jeffery-Dewitt F-200; strain S-400	Twist sleeves					
suspension	Jeffery-Dewitt	No					Jeffery-Dewitt C-200; strain S-400	Twist sleeves	Oxide film	G. E.			
suspension	Jeffery-Dewitt	No					Jeffery-Dewitt C-200; strain S-400	Twist sleeves					
suspension	Jeffery-Dewitt	No					Jeffery-Dewitt C-200; strain S-400	Compressor joints					
,622	Ohio Brass	No					Ohio Brass No. 70,731, 9¾"	Sleeve compression					
No. 25,622	Ohio Brass	No		Flux control			Thomas No. 10,089, 8"	Sleeves	Aluminum cell	G. E.			
No. 25,622	Ohio Brass	No		15			Thomas No. 10,089, 8"	Sleeves	Oxide film	G. E.			
No. 25,622	Ohio Brass	No		15			Thomas No. 10,089, 8"	Twist sleeves	Aluminum cell at ends	G. E.			
No. 10,566	Ohio Brass	No					Ohio Brass No. 11,026	Twist sleeves	Aluminum cell at ends	G. E.			
No. 25,622	Ohio Brass	No		Flux control			Thomas No. 10,089, 8"	Sleeves	Aluminum cell; ox. film	G. E.			
10,566, 12,464	Ohio Brass	No		24			Thomas No. 10,089, 8"	Sleeves	Aluminum cell; ox. film	G. E.			
No. 25,622	Ohio Brass	No		Ohio Brass flux control			Thomas No. 10,089, 8"	Twist sleeves	Aluminum cell; ox. film	G. E.	Cop		
No. 12,464	Ohio Brass	No		24			Thomas No. 10,089, 8"	Sleeves	Aluminum cell	G. E.			
No. 25,622	Ohio Brass	No		24			Locke No. 13,916—G-3, 9"	Sleeves	Aluminum cell; ox. film	G. E.			
No. 29,210	Ohio Brass	No		24			Thomas No. 10,091, 8"	Seamless sleeves	Aluminum cell	G. E.			
No. 29,210	Ohio Brass	No		24			Thomas No. 10,091, 8"	Twist sleeves					
No. 25,622	Ohio Brass	No		Special			Thomas No. 10,089, 8"	Twist seamless sleeves	Oxide film	G. E.			
No. 25,620	Ohio Brass	No		17			Thomas No. 10,091, 8"	Sleeves	Oxide film	G. E.			
No. 25,622	Ohio Brass	No		17			Thomas No. 10,091, 8"	Aluminum sleeves	Oxide film	G. E.			
No. 25,622	Ohio Brass	No		24			Ohio Brass No. 11,538, 9"	Sleeves	Aluminum cell	G. E.			
No. 25,622	Ohio Brass	No		15			Thomas No. 10,091, 8"	Compression joint	Aluminum cell	G. E.			
12,552	Ohio Brass	No						Sleeves	Aluminum cell	G. E.			
No. 10,566	Ohio Brass	No		15; 24				Sleeves	Aluminum cell	G. E.			
o. 25,622	Ohio Brass	No		24			Thomas No. 10,089, 8"	Sleeves	Aluminum cell	G. E.			
o. 25,622	Ohio Brass	No		24			Ohio Brass No. 11,538, 9"	Sleeves	Aluminum cell	G. E.			
o. 25,622	Ohio Brass	No					Thomas No. 10,089, 8"	Twist sleeves	Aluminum cell	G. E.			
		No						Twist sleeves	Aluminum cell; oxide film	G. E.			
No. 12,464	Ohio Brass	No		15			Thomas No. 10,089, 8"	Sleeves	Aluminum cell; oxide film	G. E.			
620	Ohio Brass	No		Ohio Brass No. 70,756			Ohio Brass No. 70,756	Twist sleeves	Oxide film	G. E.			
620	Ohio Brass	No		Ohio Brass No. 70,756			Ohio Brass No. 70,756	Twist sleeves	Oxide film	G. E.			
620	Ohio Brass	No		Ohio Brass No. 70,756			Ohio Barss No. 70,756	Twist sleeves	Oxide film	G. E.			
620	Ohio Brass	No		Ohio Brass No. 70,756			Ohio Brass No. 70,756	Twist sleeves	Oxide film	G. E.			
620	Ohio Brass	No		Ohio Brass No. 70,756			Ohio Brass No. 70,756	Drawn sleeve	Oxide film	G. E.			
620	Ohoi Brass	No		Ohio Brass No. 70,756			Ohio Brass No. 70,756	Twist sleeves	Oxide film	G. E.			
620	Ohio Brass	No		Ohio Brass No. 70,756			Ohio Brass No. 70,756	Twist sleeves	Auto-valve and oxide film	W'hse; G.E.			
620	Ohio Brass	No		Ohio Brass No. 70,756			Ohio Brass No. 70,756	Twist sleeves and drawn sleeves	Auto-valve	W'hse			
620	Ohio Brass	No		Ohio Brass No. 70,756			Ohio Brass No. 70,756	Twist sleeves	Auto-valve and oxide film	W'hse; G.E.			
o. 25,620	J.-D.; O. B.	No		Ohio Brass No. 70,756			Ohio Brass No. 70,756	Twist sleeves	Oxide film	G. E.			
620	Ohio Brass	No		Ohio Brass No. 70,756			Oyio Brass No. 70,756	Twist sleeves	Oxide film	G. E.			
o. 5,960	Lapp; W'hse	No		W'hse 503,759; O. B. 70,756			Ohio Brass No. 70,756	Twist sleeves	Oxide film	G. E.			
							West. No. 503,759; Ohio Brass No. 70,756	Drawn sleeve	Oxide film	G. E.			
Hewlett	Thomas	No		Yes				Sleeves	Oxide film	G. E.			
Hewlett	Thomas	No		Yes				Sleeves	Oxide film	G. E.			
ension	O. B.; W'hse						Tie wire Ohio Brass No. 11,543 on dead-ends and corners	Sleeves	Oxide film	G. E.	Siem		
12,552	Ohio Brass							Sleeves	Oxide film	G. E.	Siem		
No. 25,622	Ohio Brass							Sleeve			Siem		
sion	Lapp; W'hse						Lapp No. 5,573	Sleeve	Oxide film	G. E.	Siem		
sion	Lapp No. 2,300						Lapp No. 5,573	Sleeve	Electrolytic; oxide film	G. E.	Siem		
No. 2,300	Lapp						Crosby	Sleeve	Oxide film	G. E.			
7,500—G-2	Locke						Locke No. 8,451—G-1	Sleeve	Oxide film	G. E.	Siem		
No. 2,300	Lapp						Crosby	Sleeve	Oxide film	G. E.			
n No. 25,622	O. B.; W'hse						Tie wire Ohio Brass No. 11,543	Sleeve			Siem		
No. 25,622	Ohio Brass			Clamps			Ohio Brass No. 70,701 with arcing horns	Sleeve	Oxide film; electrolytic	G.E.; W'hse	Siem		
n No. 25,622	Ohio Brass						Tie wire Ohio Brass No. 11,543		Oxide film	G. E.	Siem		
No. 25,622	Ohio Brass						Lapp No. 5,573	Sleeve			Siem		
sion	Ohio Brass						Ohio Brass No. 70,249	Sleeve	Oxide film	G. E.	Siem		
	Ohio Brass						Tie wire	Sleeve	Electrolytic	G. E.	Siem		
n No. 26,522	O. B.; W'hse						Tie wire Ohio Brass No. 11,543		Oxide film	G. E.	Siem		
No. 25,622	Ohio Brass						Ohio Brass No. 70,249; 11,543	Sleeve	Oxide film	G. E.	Siem		
sion	Ohio Brass						Ohio Brass No. 70,249	Sleeve	Oxide film	G. E.			
pension	Ohio Brass						Tie wire Ohio Brass No. 11,543		Oxide film	G. E.	Siem		
							Tie wire	Sleeve	Oxide film	G. E.			
a pin	O. B.; W'hse; L.						Tie wire	Sleeve	Electrolytic; oxide film	G. E.			
sion	Ohio Brass						Ohio Brass No. 70,249	Sleeve	Electrolytic	G. E.	Siem		
sion	Ohio Brass						Ohio Brass No. 70,249	Sleeve	Electrolytic	W'hse	Siem		
suspension	Ohio Brass						Tie wire Ohio Brass No. 11,543	Sleeve	Oxide film	G. E.	Siem		
sion	O. B.; Lapp						Ohio Brass No. 70,249	Sleeve	Oxide film	G. E.	Siem		
n No. 25,622	O. B.; W'hse						Tie wire Ohio Brass No. 11,543	Sleeve	Oxide film	G. E.	Siem		
	O. B.; W'hse						Tie wire	Sleeve			Siem		
sion	Ohio Brass						Ohio Brass No. 70,249	Sleeve			Siem		
No. 6,294	Lapp						Lapp No. 5,573	Sleeve	Oxide film	G. E.	Siem		
sion	Ohio Brass						Ohio Brass No. 70,249	Sleeve	Oxide film	G. E.	Siem		
sion	Ohio Brass						Ohio Brass No. 73,430	Sleeve	Oxide film	G. E.	Siem		
No. 25,622	Ohio Brass						Ohio Brass No. 70,249	Sleeve	Oxide film	G. E.	Siem		
ension	O. B.; W'hse						Tie wire Ohio Brass No. 11,543	Sleeve	Oxide film	G. E.	Siem		
pin disc	W'hse; Thomas						Thomas No. 10,005 and 10,062	Twist sleeve	Oxide film	G. E.			
link	Thomas							Twist sleeve	Oxide film	G. E.			
d pin	Ohio Brass						4-bolt	Twist sleeve	Oxide film	G. E.			
link	Thomas						Ohio Brass No. 72,366	McIntyre sleeve No. 527	Oxide film	G. E.			
ll socket con.	Ohio Brass						Thomas No. 10,002	Double barrel twist sleeve	Aluminum cell; oxide film	G. E.			
e No. 5,800	Locke						Ohio Brass No. 72,366	McIntyre sleeve No. 527	Oxide film	G. E.			
e No. 57,139	Thomas						Clevis-3-bolt, .68—.30"	3-section sleeve	Oxide film	G. E.			
t disc	Ohio Brass						4-bolt	Double barrel twist sleeve	Oxide film; auto-valve	G.E.; W'hse			
No. 25,622	Ohio Brass						Ohio Brass No. 70,755	Cu. sleeve splice	1 e'lytic; 1 auto-valve; 2 ox. film	G.E.; W'hse	G		
7210	Locke							Sleeve splice	S. V. auto-valve	W'hse			
No. 25,622	Ohio Brass						Ohio Brass No. 11,538	Sleeve splice	S. V. auto-valve	W'hse			
3166	Westinghouse							Sleeve splice	Oxide film	G. E.			
No. 25,622	Ohio Brass						Ohio Brass No. 11,538	Cu. sleeve splice	2 oxide film; 3 S. V.	G.E.; W'hse			
No. 25,622	Ohio Brass							Sleeve splice	3 electrolytic; 1 S. V.	W'hse			
No. 25,622	Ohio Brass						Ohio Brass No. 70,755	Cu. sleeve splice	2 S. V.; 4 el ectrolytic; 3 oxide film	W'hse; G.E.	G		
No. 25,622	Ohio Brass							Sleeve splice	Electrolytic	W'hse			
No. 25,622	Ohio Brass						Ohio Brass No. 11,538	Cu. sleeve splice	Oxide film	G. E.			
, double arm	Ohio Brass						Ohio Brass No. 11,538	Cu. sleeve splice	Oxide film	G. E.			
								Sleeve splice	Oxide film	G. E.			
sion	Lapp			Lapp			Lapp No. 511 with arcing horns	Splicing sleeves	Oxide film; auto-valve	G.E.; W'hse			

EAST NORTH CENTRAL—Continued

	No. of Footnote	No of. Line	
	(35)	142, 143, 150	(Northern States Pwr. Co. of Wisconsin) Rebuilt latter year.
	(36)	144	(Northern States Pwr. Co. of Wisconsin) Line to Eau Claire Sand & Gravel Co., 13.2 kv. crosses river with this circuit.
o each insulator string.	(37)	148	(Northern States Pwr. Co. of Wisconsin) 4 steel, 614 wood, 2 iron.
	(38)	156	(Northern States Pwr. Co. of Wisconsin) This line contacts for 4.4 miles on Sparta—Viroqua line, not included here.
	(39)	157	(Northern States Pwr. Co. of Wisconsin) 2—69 kv., 1—2,300 volts, 3 phase.
	(40)	160	(Northern States Pwr. Co. of Wisconsin) Contact of 0.2 miles on Menomonie—Red Wing line.
	(41)	161	(Northern States Pwr. Co. of Wisconsin 24.7 miles of 1—69 kv. circuit, joint lines: 4.4 miles 2—69 kv., 2.5 miles 1—69 kv. and 1—6.9 kv.; double circuit of: 69 kv. from Sparta to a point 4.4 miles south, 69 kv. and 6.9 kv. from Junction of Melvina line on 69 kv. to Cashton Junction, 2.5 miles joint line.
	(42)	162	(Northern States Pwr. Co. of Wisconsin) 8.3 miles—4 kv. and 69 kv.; 15.2 miles—13.2 kv. and 69 kv.
	(43)	163	(Northern States Pwr. Co. of Wisconsin) Joint lines: 7.25 miles 69 kv. and 2.3 kv., 16.80 miles 69 kv., 3.5 miles 69 kv. and 13.2 kv.
	(44)	179	(Wisconsin Public Service Corp.) Six miles built in 1910.
	(45)	185	(Wisconsin Public Service Corp.) 4 miles built in 1926.

used, 5 units on line and
used).

5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio Brass	No					Ohio Brass No. 70,730
6	Suspension No. 25,622	Ohio Brass	7	Suspension No. 25,620	Ohio Brass	No					Ohio Brass No. 70,730
5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio Brass	No					Ohio Brass No. 70,730
5	Suspension	Westinghouse	6	Suspension	Westinghouse	No					
5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio Brass	No					Ohio Brass No. 70,730
1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio Brass	No					Ohio Brass No. 11,541
1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio Brass	No					Ohio Brass No. 11,541
1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio Brass	No					Ohio Brass No. 11,541
4	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio Brass	No					Ohio Brass No. 11,541
1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio Brass	No					Ohio Brass No. 11,541
1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio Brass	No					Ohio Brass No. 11,541
nd 9	Jeffery-Dewitt A-257	Jeffery-Dewitt	8 and 9(24)	Jeffery-Dewitt A-257	Jeffery-Dewitt	No		Ohio Brass			Ohio Brass No. 73,179
nd 9	Jeffery-Dewitt A-257	Jeffery-Dewitt	8 and 9(24)	Jeffery-Dewitt A-257	Jeffery-Dewitt	No		Jeffery-Dewitt	Oval		Jeffery-Dewitt CH 200 and S 400
nd 9	Jeffery-Dewitt A-257	Jeffery-Dewitt	8 and 9(24)	Jeffery-Dewitt A-257	Jeffery-Dewitt	No		Ohio Brass			Ohio Brass No. 73,179
1	Pin	Ohio Brass	6	No. 25622 suspension	Ohio Brass	No					Ohio Brass No. 11,541
1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio Brass	No					Ohio Brass No. 11,541
1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio Brass	No					Ohio Brass No. 11,541
1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio Brass	No					Ohio Brass No. 11,541
5	Franklin suspension	E. S. supplies	5	Franklin suspension	E. S. supplies	No					Ohio Brass No. 11,541
1	Pin	Ohio Brass	6	No. 25,622 suspension	Ohio Brass	No					Ohio Brass No. 11,541
5	Hewlett	Thomas	6	Hewlett	Thomas	No		Plain			Thomas No. 10,092; strain Ohio Brass 11,328
5	Hewlett	Thomas	6	Hewlett	Thomas	No		Plain			Thomas No. 10,092; strain Ohio Brass 11,328
5	Hewlett	Thomas	6	Hewlett	Thomas	No		Plain			Thomas No. 5,717 strain Ohio Brass 70,231
5	Hewlett	Locke	6	Hewlett	Locke	No		Plain			Thomas 10,092; Locke 3,045; Ohio Brass 70,231
5	Cem. cap ball and socket	Ohio Brass	6	Cemented cap ball and socket	Ohio Brass	No		Plain			Ohio Brass Nos. 70,701; 70,249; 70,250
8	A-257	Jeffery-Dewitt	9	A-257	Jeffery-Dewitt	No					Jeffery-Dewitt C 200; Jeffery-Dewitt D 306
6	No. 25,622	Ohio Brass	7	No. 25,622	Ohio Brass	No		Special design			Ohio Brass No. 73,511, 13½"
7	No. 2,094 and No. 5,960	Lapp	8	No. 2,094 and 5,960	Lapp	No		Special design			Ohio Brass No. 70,731, 70,231, 9¾", 12¾"
6	No. 25,620	Ohio Brass	8	No. 25,620	Ohio Brass	No					Ohio Brass No. 11,041, 8¼"
6	No. 5,960	Lapp	7	No. 5,960	Lapp	No		Special design			Ohio Brass No. 73,037; Ohio Brass 73,509
l top)	Suspension	Ohio Brass	12	Strain	Ohio Brass	No		Ohio Brass flux controls			Thomas No. 10,091 suspension, 8"
4(20)		Jeffery-Dewitt	5		Jeffery-Dewitt	No					
8	Jeffery-Dewitt	Jeffery-Dewitt	9	Jeffery-Dewitt	Jeffery-Dewitt	No					Locke trunnion
10	Cap and pin	Locke	11	Cap and pin	Locke	No					
7	B. & S. suspension No. 18,400	Locke	8	B. & S. suspension No. 18,400	Locke			Yes			Ohio Brass No. 70,756 and No. 71,091
7	B. & S. suspension No. 18,400	Locke	8	B. & S. suspension No. 18,400	Locke			Yes			Ohio Brass No. 72,703 and No. 70,756
11	No. 25,620	Ohio Brass	22	No. 25,622	Ohio Brass	No					Ohio Brass
7	B. & S. suspension No. 18,400	Locke	8	B. & S. suspension No. 18,400	Locke			Yes			Locke No. 118 Universal
5	Suspension	W'hse No. 601	6	Suspension	W'hse No. 631	No					
5	Jeffery-Dewitt	Jeffery-Dewitt	5	High strength	Lapp	No					Jeffery-Dewitt C-300; strain Ohio Brass No. 70,231
8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspension	Jeffery-Dewitt	No					Jeffery-Dewitt C-200; strain D-306
8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspension	Jeffery-Dewitt	No					Jeffery-Dewitt C-200; strain D-306
8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspension	Jeffery-Dewitt	No					Jeffery-Dewitt C-200; strain D-306
8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspension	Jeffery-Dewitt	No					Jeffery-Dewitt C-200; strain D-306
8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspension	Jeffery-Dewitt	No				22	Jeffery-Dewitt F-200; strain S-400
8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspension	Jeffery-Dewitt	No					Jeffery-Dewitt C-200; strain S-400
8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspension	Jeffery-Dewitt	No					Jeffery-Dewitt C-200; strain S-400
8	Suspension	Jeffery-Dewitt	8	Jeffery-Dewitt suspension	Jeffery-Dewitt	No					Jeffery-Dewitt C-200; strain S-400
string	No. 25,622	Ohio Brass	20 to 53	No. 25,622	Ohio Brass	No					Ohio Brass No. 70,731, 9¾"
0	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,622	Ohio Brass	No		Flux control			Thomas No. 10,089, 8"
0	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,622	Ohio Brass	No		15			Thomas No. 10,089, 8"
7	Ohio Brass No. 25,622	Ohio Brass	6	Ohio Brass No. 25,622	Ohio Brass	No		15			Thomas No. 10,089, 8"
7	Suspension No. 10,566	Ohio Brass	8	Suspension No. 10,566	Ohio Brass	No					Ohio Brass No. 11,026
9	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,622	Ohio Brass	No		Flux control			Thomas No. 10,089, 8"
0	Susp. No. 10,566; 12,464; 25,622	Ohio Brass	10—12	Suspension No. 10,566, 12,464	Ohio Brass	No		24			Thomas No. 10,089, 8"
9	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,622	Ohio Brass	No		Ohio Brass flux control			Thomas No. 10,091, 8"
0	Suspension No. 12,464	Ohio Brass	10—12	Suspension No. 12,464	Ohio Brass	No		24			Thomas No. 10,089, 8"
0	Suspension No. 25,622	Ohio Brass	10—12	Suspension No. 25,622	Ohio Brass	No		24			Locke No. 13,916—G-3, 9"
0	Suspension No. 29,210	Ohio Brass	11	Suspension No. 29,210	Ohio Brass	No		24			Thomas No. 10,091, 8"
—11	Suspension No. 29,210	Ohio Brass	11—12	Suspension No. 29,210	Ohio Brass	No		24			Thomas No. 10,091, 8"
0	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,622	Ohio Brass	No		Special			Thomas No. 10,089, 8"
—11	Suspension No. 25,620	Ohio Brass	11—12	Suspension No. 25,620	Ohio Brass	No		17			Thomas No. 10,091, 8"
0	Suspension	Ohio Brass	11	Suspension No. 25,622	Ohio Brass	No		17			Thomas No. 10,091, 8"
0	Suspension No. 25,622	Ohio Brass	10—12	Suspension No. 25,622	Ohio Brass	No		24			Ohio Brass No. 11,538, 9"
0	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,622	Ohio Brass	No		15			Thomas No. 10,091, 8"
1	Pin No. 12,552	Ohio Brass	1	Pin No. 12,552	Ohio Brass	No					
10	Susp. No. 10,566; 25,622; 29,219	Ohio Brass	10—12	Suspension No. 10,566	Ohio Brass	No		15; 24			
0	Suspension No. 25,622	Ohio Brass	12	Suspension No. 25,622	Ohio Brass	No		24			Thomas No. 10,089, 8"
0	Suspension No. 25,622	Ohio Brass	10—12	Suspension No. 25,622	Ohio Brass	No		24			Ohio Brass No. 11,538, 9"
1	Pin No. 12,522	Ohio Brass	7	Suspension No. 25,622	Ohio Brass	No					Thomas No. 10,089, 8"
1	Pin	Ohio Brass				No					
10	Susp. No. 10,566; No. 25,622	Ohio Brass	12	Suspension No. 12,464	Ohio Brass	No		15			Thomas No. 10,089, 8"
9	No. 25,620	Ohio Brass	10	No. 25,620	Ohio Brass	No		Ohio Brass No. 70,756			Ohio Brass No. 70,756
9	No. 25,620	Ohio Brass	10	No. 25,620	Ohio Brass	No		Ohio Brass No. 70,756			Ohio Brass No. 70,756
9	No. 25,620	Ohio Brass	10	No. 25,620	Ohio Brass	No		Ohio Brass No. 70,756			Ohio Barss No. 70,756
9	No. 25,620	Ohio Brass	10	No. 25,620	Ohio Brass	No		Ohio Brass No. 70,756			Ohio Brass No. 70,756
9	No. 25,620	Ohio Brass	10	No. 25,620	Ohio Brass	No		Ohio Brass No. 70,756			Ohio Brass No. 70,756
9	No. 25,620	Ohio Brass	10	No. 25,620	Ohio Brass	No		Ohio Brass No. 70,756			Ohio Brass No. 70,756
9	No. 25,620	Ohio Brass	10	No. 25,620	Ohio Brass	No		Ohio Brass No. 70,756			Ohio Brass No. 70,756
10	No. 25,620	Ohio Brass	11	No. 25,620	Ohio Brass	No		Ohio Brass No. 70,756			Ohio Brass No. 70,756
9	No. 25,620	Ohio Brass	10	No. 25,620	Ohio Brass	No		Ohio Brass No. 70,756			Ohio Brass No. 70,756
9	No. 25,620	Ohio Brass	10	No. 25,620	Ohio Brass	No		Ohio Brass No. 70,756			Ohio Brass No. 70,756
—9	No. A-257; No. 25,620	J.-D.; O. B.	8—10	No. A-257; No. 25,620	J.-D.; O. B.	No		Ohio Brass No. 70,756			Ovio Brass No. 70,756
9	No. 25,620	Ohio Brass	10	No. 25,620	Ohio Brass	No		Ohio Brass No. 70,756			Ohio Brass No. 70,756
9	No. 641; No. 5,960	W'hse; Lapp	10	No. 641; No. 5,960	Lapp; W'hse	No		W'hse 503,759; O. B. 70,756			West. No. 503,759; Ohio Brass No. 70,756
4	Suspension Hewlett	Thomas	5	Suspension Hewlett	Thomas	No		Yes			
6	Suspension Hewlett	Thomas	7	Suspension Hewlett	Thomas	No		Yes			
1	Pin	O. B.; W'hse	1; 6(24)	Pin, suspension	O. B.; W'hse						Tie wire Ohio Brass No. 11,543 on dead-ends and corners
1	Pin	Ohio Brass	1; 6(24)	Pin No. 12,552	Ohio Brass						
1	Pin No. 12,552	Ohio Brass	1; 6(24)	Suspension No. 25,622	Ohio Brass						
5	Suspension	Lapp; W'hse	6	Suspension	Lapp; W'hse						Lapp No. 5,573
4	Suspension	O. B.; Lapp	5	Suspension	Lapp No. 2,300						Lapp No. 5,573
			7	Suspension No. 2,300	Lapp						Crosby
8	Suspension No. 7,500—T-2	Locke	9	Suspension No. 7,500—G-2	Locke						Locke No. 8,451—G-1
			7	Suspension No. 2,300	Lapp						Crosby
1	Pin	O. B.; W'hse	1; 6(24)	Pin, suspension No. 25,622	O. B.; W'hse						Tie wire Ohio Brass No. 11,543
5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass			Clamps			Ohio Brass No. 70,701 with arcing horns
1	Pin	Ohio Brass	1; 6(24)	Pin, suspension No. 25,622	Ohio Brass						Tie wire Ohio Brass No. 11,543
5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass						Lapp No. 5,573
5	Suspension	Ohio Brass	6	Suspension	Ohio Brass						Ohio Brass No. 70,249
1	Pin	Ohio Brass	2(24)	Pin	Ohio Brass						Tie wire
1	Pin	O. B.; W'hse	1; 6(24)	Pin, suspension No. 26,522	O. B.; W'hse						Tie wire Ohio Brass No. 11,543
8	Suspension No. 25,622	Ohio Brass	9	Suspension No. 25,622	Ohio Brass						Ohio Brass No. 70,249; 11,543
5	Suspension	Ohio Brass	6	Suspension	Ohio Brass						Ohio Brass No. 70,249
1	Pin	Ohio Brass	6(24)	Pin, suspension	Ohio Brass						Tie wire Ohio Brass No. 11,543
1	Pin	Ohio Brass									Tie wire
1	Waconia pin	O. B.; W'hse; La.	1	Waconia pin	O. B.; W'hse; L.						Tie wire
5	Suspension	Ohio Brass	6	Suspension	Ohio Brass						Ohio Brass No. 70,249
1	Suspension, Waconia pin	Ohio Brass	6	Suspension	Ohio Brass						Ohio Brass No. 70,249
3	Pin	Ohio Brass	1; 6(24)	Pin No. 12,552 suspension	Ohio Brass						Tie wire Ohio Brass No. 11,543
4	Suspension	Ohio Brass	5	Suspension	O. B.; Lapp						Ohio Brass No. 70,249
3	Pin	O. B.; W'hse	1; 6(24)	Pin, suspension No. 25,622	O. B.; W'hse						Tie wire Ohio Brass No. 11,543
	Pin	O. B.; W'hse	2(24)	Pin	O. B.; W'hse						Tie wire
5	Suspension	Ohio Brass	6	Suspension	Ohio Brass						Ohio Brass No. 70,249
5	Suspension No. 6,294	Lapp	6	Suspension No. 6,294	Lapp						Lapp No. 5,573
5	Suspension	Ohio Brass	6	Suspension	Ohio Brass						Ohio Brass No. 70,249
8	Suspension	Ohio Brass	9	Suspension	Ohio Brass						Ohio Brass No. 73,430
8	Suspension	Ohio Brass	9	Suspension No. 25,622	Ohio Brass						Ohio Brass No. 70,249
1	Pin	O. B.; W'hse	1; 6(24)	Pin, suspension	O. B.; W'hse						Tie wire Ohio Brass No. 11,543
5	Clevis and pin disc	W'hse; Thomas	6	Clevis and pin disc	W'hse; Thomas						Thomas No. 10,005 and 10,062
5	Hewlett Link	Thomas	6	Hewlett link	Thomas						
5	Clevis and pin	Ohio Brass	6	Clevis and pin	Ohio Brass						4-bolt
4	Hewlett Link	Thomas	5	Hewlett link	Thomas						Ohio Brass No. 72,366
4	Cap and Link, cap and pin	O. B.; Thomas	5	Cap and pin; ball socket con.	Ohio Brass						Thomas No. 10,002
5	Cap and pin disc No. 5,800	Locke	6	Cap and pin disc No. 5,800	Locke						Ohio Brass No. 72,366
5	Cap and pin disc No. 57,139	Thomas	6	Cap and pin disc No. 57,139	Thomas						Clevis-3-bolt, 68— 30"
4	Ball socket disc	Ohio Brass	5	Ball socket disc	Ohio Brass						4-bolt
5	Suspension No. 25,622	Ohio Brass	5	Suspension No. 25,622	Ohio Brass						
1	Pin No. 7,210	Locke	2 (doubled armed)	Pin No. 7210	Locke						Ohio Brass No. 70,755
5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass						
1	Pin No. 3,166	Westinghouse	2 (doubled armed)	Pin No. 3166	Westinghouse						Ohio Brass No. 11,538
5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass						
1	Pin No. 10,748	Ohio Brass	5	Suspension No. 25,622	Ohio Brass						Ohio Brass No. 11,538
5	Suspension No. 25,622	Ohio Brass	5	Suspension No. 25,622	Ohio Brass						
1	Pin No. 10,748	Ohio Brass	5	Suspension No. 25,622	Ohio Brass						Ohio Brass No. 70,755
5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass						
5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass						Ohio Brass No. 11,538
1	Pin No. 10,748	Ohio Brass	2	Pin No. 10,748, double arm	Ohio Brass						Ohio Brass No. 11,538
8	Suspension No. 2,300	Lapp	9	Suspension	Lapp			Lapp			Lapp No. 511 with arcing horns

EAST NORTH CENTRAL—Continued

(Illinois Elec. Pwr. Co.) Ultimate 2.
(Illinois Northern Utilities Co.) Ultimate 2.
(Illinois Northern Utilities) In 1929 this line will be changed to 132 kv. by adding 4 J.-D. units to each insulator string.
(Illinois Pwr. & Lt. Corp.) 8.6 miles I. P. & L. Corp. and 4 miles Union Elec. Co. of Ill.
(Illinois Pwr. & Lt. Corp.) 380,000 volts dry flashover, 305,000 volts dry flashover.
(Public Service Co. of Northern Illinois) Two on towers available, one in use, one on poles.
(Public Service Co. of Northern Illinois) Over each circuit.
(Public Service Co. of Northern Illinois) Line No. 6581 on same tower line as line No. 6582.
(Public Service Co. of Northern Illinois) To Evanston in 1924, to City limits in 1927.
(Public Service Co. of Northern Illinois) Line No. 1601 on same tower line as line No. 1602.
(Public Service Co. of Northern Illinois) See footnote 19.
(The Detroit Edison Co.) Per Circuit.
(The Detroit Edison Co.) Anchors included.
(The Detroit Edison Co.) To be connected shortly.
(Northern States Pwr. Co. of Wisconsin) Joint line 1—69 kv. 1—6.9 kv.
(Northern States Pwr. Co. of Wisconsin) 1—69 kv. and 6.9 kv.
(Northern States Pwr. Co. of Wisconsin) On all new pole installations standard construction used, 5 units on line and 6 on dead ends and corners (O. B. No. 25,622 susp. used).

EAST NORTH CENTRAL—Continued

No. of Footnote	No of. Line	
(23)	142, 143, 150	(Northern States Pwr. Co. of Wisconsin) Rebuilt latter year.
(26)	144	(Northern States Pwr. Co. of Wisconsin) Line to Eau Claire Sand & Gravel Co., 13.2 kv. crosses river
(27)	148	(Northern States Pwr. Co. of Wisconsin) 4 steel, 614 wood, 2 iron.
(28)	156	(Northern States Pwr. Co. of Wisconsin) This line contacts for 4.4 miles on Sparta—Viroqua line, not
(29)	157	(Northern States Pwr. Co. of Wisconsin) 2—69 kv., 1—2,300 volts, 3 phase.
(40)	160	(Northern States Pwr. Co. of Wisconsin) Contact of 0.2 miles on Menomonie—Red Wing line.
(41)	161	(Northern States Pwr. Co. of Wisconsin 24.7 miles of 1—69 kv. circuit, joint lines: 4.4 miles 2—69 kv., circuit of: 69 kv. from Sparta to a point 4.4 miles south, 69 kv. and 6.9 kv. from Junction of Melvin miles joint line.
(42)	162	(Northern States Pwr. Co. of Wisconsin) 8.3 miles—4 kv. and 69 kv.; 15.2 miles—13.2 kv. and 69 kv.
(43)	163	(Northern States Pwr. Co. of Wisconsin) Joint lines: 7.25 miles 69 kv. and 2.3 kv., 16.80 miles 69 kv.,
(44)	179	(Wisconsin Public Service Corp.) Six miles built in 1910.
(45)	185	(Wisconsin Public Service Corp.) 4 miles built in 1926.

Twist joints								
Twist joints								
Twist joints							Carrier current	39
Twist sleeves	1 oxide film; 1 s. v.	G. E.; W'se	Copperweld strand	5/16	1	Driven iron pipe	Westinghouse carrier current	60
Twist sleeves	3 oxide film	G. E.					Westinghouse carrier current	61
Twist sleeves	1 oxide film; 2 s. v.	G. E., W'se	Copperweld strand	5/16	1	Driven iron pipe	Westinghouse carrier current	62
Twist sleeves	Oxide film (each end)	G. E.					Westinghouse carrier current	63
Twist sleeves	3 oxide film	G. E.	Copperweld stran	5/16	1	Driven iron pipe	Westinghouse carrier current	64
Twist sleeves	Oxide film (each end)	G. E.					Westinghouse carrier current	65
Hydraulic compression	Oxide film	G. E.	Galvanized steel str.	1/4	1(25)	No. 2 cu. at diagonal corners of tower	Carrier current and telephone	66
Cu. sleeves twisted 4 times	Oxide film	G. E.	Galvanized steel str.	1/4	1(25)	No. 2 cu. at diagonal corners of tower	Carrier current and telephone	67
Hydraulic compression	Oxide film	G. E.	Galvanized steel str.	1/4	1(25)	No. 2 cu. at diagonal corners of tower	Carrier current and telephone	68
Twist sleeves	Oxide film	G. E.					Westinghouse carrier current	69
Twist sleeves	Oxide film	G. E.					Westinghouse carrier current	70
Twist sleeves	Oxide film	G. E.					Westinghouse carrier current	71
Twist sleeves	Oxide film	G. E.					Westinghousecarrier current	72
Twist sleeves	Oxide film	G. E.					Westinghouse carrier current	73
Twist sleeves	Oxide film	G. E.					Westinghouse carrier current	74
Twist sleeves	Oxide film	G. E.	Siemens-Martin steel	3/16	1	No. 2 cu. spiralled on butt of pole	Wire	75
Twist sleeves	Oxide film	G. E.	Siemens-Martin steel	3/16	1	No. 2 cu. spiralled on butt of pole	Wire	76
Compression joint	Oxide film	G. E.	Siemens-Martin steel	3/16	1	Anchors grounded	Wire	77
Twist sleeves	Oxide film	G. E.	Siemens-Martin steel	3/16	1	Anchors grounded	Wire	78
Compressed joint	Oxide film	G. E.	Siemens-Martin steel	1/4	1	Anchors grounded	Wire	79
Twist sleeves	Oxide film	G. E.; El. Pr. Eq.	A.C.S.R.	1/0	1 and 2(18)	Iron pipe—2 per tower	Carrier current	80
Sleeve compression	Oxide film	G. E.	A.C.S.R.	No. 1/0	1	Sherardised rod	Bell telephone	81
Sleeve compression	Oxide film	G. E.	Red brass	7/16	2	Sherardised rod	Bell telephone	82
Sleeve compression	Aluminum	G. E.	Copperweld	No. 1/0	1	Cables and rods	Private telephone	83
Sleeve compression	Oxide film	G. E.	A.C.S.R.	No. 1/0	1	Sherardised rod	Bell telephone	84
Sleeves	Autovalve	W'hse				Driven pipe	Westinghouse carrier current	85
Compression	Oxide film (at terminals)	G. E.			2			
	Oxide film (at terminals)	G. E.				Each pole has vertical ground wire		88
Tw. sl.; compr. sl. for core	Oxide film B. O.	G. E.	A.C.S.R.	134,600	1	2 copperweld rods, 1/2"x10'	A. T. & T. Co. leased line and local Bell	89(a)
Tw. sl.; compr. sl. for core	Oxide film B. O.	G. E.	A.C.S.R.	110,000	1	2 copperweld rods, 1/2"x10'	Company owned telephone	89(b)
Compression	2	G. E.	Aluminum	159,000 c.m.	1		Carrier current 67 K.C.	89(c)
Twist sleeves	Oxide film B. O.	G. E.	Copperweld (30%)	1/17 strand	1	2 copperweld rods, 1/2"x10'	Company-owned telephone	89(d)
	Oxide film (each end)	G. E.				2/10' 1" galvanised pipe	Bell system	90
Twist sleeves	Oxide film	G.E.	A.C.S.R.	No. 1/0	1(24)	2/10' iron pipes on all towers with concrete bases	Company telephone	91
Twist sleeves			A.C.S.R.	No. 1/0	1(24)		Carrier current telephone	92
Twist sleeves			A.C.S.R.	No. 1/0	1(24)		Carrier current telephone	93
Twist sleeves			A.C.S.R.	No. 1/0	1(24)		Carrier current telephone	94
Twist sleeves			A.C.S.R.	134,560 c.m.	1(24)		Carrier current telephone	95
Twist sleeves			A.C.S.R.	No. 3/0	1(24)		Company telephone	96
Twist sleeves	Oxide film	G. E.	A.C.S.R.	No. 3/0	1(24)		Company telephone	97
Twist sleeves			A.C.S.R.	134,560 c.m.	1(24)		Carrier current telephone	98
Compressor joints			A.C.S.R.	No. 1/0	1(24)		Carrier current telephone	99
Sleeve compression							Carrier current	100
Sleeves	Aluminum cell	G. E.					Private telephone; carrier	101
Sleeves	Oxide film	G. E.					Private telephone; carrier	102
Twist sleeves	Aluminum cell at ends	G. E.					Private telephone; carrier	103
Twist sleeves	Aluminum cell at ends	G. E.					Private telephone; carrier	104
Sleeves	Aluminum cell; ox. film	G. E.					Carrier current	105
Sleeves	Aluminum cell; ox. film	G. E.					Private telephone	106
Twist sleeves	Aluminum cell; ox. film	G.E.	Copperweld—7 str.	3/8			Leased wire telephone	107
Sleeves	Aluminum cell	G.E.					Private telephone	108
Sleeves	Aluminum cell; ox. film	G.E.					Private telephone	109
Seamless sleeves	Aluminum cell	G.E.	Copperweld	3/4 S.T.	2		2-wire poles, paralleling line	110
Twist sleeves							None	111
Twist seamless sleever	Oxide film	G. E.					2-wire, poles paralleling line	112
Sleeves	Oxide film	G. E.	Copperweld	3/8	1	Driven rod	None	113
Aluminum sleeves	Oxide film	G. E.	A.C.S.R.	101,790 c.m.	1		Private telephone	114
Sleeves	Aluminum cell	G. E.	Copperweld	No. 4	1		Private telephone	115
Compression joint	Aluminum cell	G. E.					Private telephone	116
Sleeves	Aluminum cell	G. E.	Iron	No. 4	1	Coil under pole butt	Private telephone	117
Sleeves	Aluminum cell	G. E.					Private telephone	118
Sleeves	Aluminum cell	G. E.						119
Sleeves	Aluminum cell	G. E.					Private telephone	120
Twist sleeves	Aluminum cell	G. E.					Private telephone	121
Twist sleeves	Aluminum cell; oxide film	G. E.					None	122
Sleeves	Aluminum cell; oxide film	G. E.					Private telephone	123
							Leased line	
Twist sleeves	Oxide film	G. E.	Cu.	000	1	Grillage anchor	Telephone on wood poles	124
Twist sleeves	Oxide film	G. E.	Cu.	000	1	Grillage anchor	Telephone on wood poles	125
Twist sleeves	Oxide film	G. E.	Cu.	000	1	Grillage anchor	Telephone on wood poles; carrier	126
Twist sleeves	Oxide film	G. E.	Cu.	000	1	Grillage anchor	Telephone on wood poles	127
Drawn sleeve	Oxide film	G. E.	Cu.	000	1	Grillage anchor	Telephone on wood poles	128
Twist sleeves	Oxide film	G. E.	Cu.	000	1	Grillage anchor	Telephone on wood poles	129
Twist sleeves	Auto-valve and oxide film	W'hse; G.E.	Cu.	000	1	Grillage anchor	Telephone on wood poles; carrier	130
Twist sleeves and drawn sleeves	Auto-valve	W'hse	Copperweld	7/16	2	Grillage anchor	Telephone on wood poles; carrier	131
Twist sleeves	Auto-valve and oxide film	W'hse; G.E.	Cu.	000	1	Grillage anchor	Telephone on wood poles	132
Twist sleeves	Oxide film	G. E.	Cu.	000	1	Grillage anchor	Telephone on wood poles	133
Twist sleeves	Oxide film	G. E.	Cu.	000	1	Grillage anchor	Telephone on wood poles; carrier	134
Twist sleeves	Oxide film	G. E.	Cu.	000	1	Grillage anchor	Telephone on wood poles; carrier	135
Drawn sleeve	Oxide film	G. E.	Cu.	000	1	Grillage anchor	Telephone on wood poles	136
Sleeves	Oxide film	G. E.						137
Sleeves	Oxide film	G. E.					Carrier, private line	138
	Oxide film	G. E.	Siemens-Martin steel	1/4	1	1/4" S.-M.	Carrier current telephone	139
Sleeves	Oxide film	G. E.	Siemens-Martin steel	5/16	1	No. 6 Cu.	Bell	140
Sleeve			Siemens-Martin steel	5/16	1	No. 6 W. P.	Bell and private	141
Sleeve	Oxide film	G. E.	Siemens-Martin steel	5/16	1	No. 4 iron	Bell and private	142
Sleeve	Electrolytic; oxide film	G. E.	Siemens-Martin steel	5/16	1	No. 6 solid iron	Bell and private	143
Sleeve	Oxide film	G. E.				No. 4 solid iron	Bell and private	144
Sleeve	Oxide film	G. E.	Siemens-Martin steel	3/8	1		Bell and private	145
Sleeve	Oxide film	G. E.				No. 4 solid iron	Bell and private	146
Sleeve			Siemens-Martin steel	1/4	1	1/4" S.-M.	Bell and private	147
Sleeve	Oxide film; electrolytic	G.E.; W'hse	Siemens-Martin steel	1/4	2	1/4" S.-M.	Bell and private	148
	Oxide film	G. E.	Siemens-Martin steel	1/4	1	1/4" messenger	Bell and private	149
Sleeve			Siemens-Martin steel	5/16	1	No. 6 iron	Bell and private	150
Sleeve	Oxide film	G. E.	Siemens-Martin steel	5/16	1	5/16" S.-M.	Private	151
Sleeve	Electrolytic	G. E.	Siemens-Martin steel	1/4	1	1/4" S.-M.	Bell and private	152
	Oxide film	G. E.	Siemens-Martin steel	1/4	1	1/4" S.-M.	Bell and private	153
Sleeve	Oxide film	G. E.	Siemens-Martin steel	1/2	1		Bell and private	154
Sleeve	Oxide film	G. E.					Bell	155
	Oxide film	G. E.	Siemens-Martin steel	3/8	1	No. 6 W. P.	Bell and private	156
Sleeve	Oxide film	G. E.	Iron	No. 4	1		Bell and private	157
Sleeve	Electrolytic; oxide film	G. E.	Iron	No. 4 solid	1		Private	158
Sleeve	Electrolytic	G. E.	Siemens-Martin steel	1/4	1	1/4" S.-M.	Bell and private	159
Sleeve	Electrolytic	W'hse	Siemens-Martin steel	5/16	1	No. 6 Cu. on pole line	Bell and private	160
Sleeve	Oxide film	G. E.	Siemens-Martin steel	5/16	1	No. 6 W. P.	Bell and private	161
Sleeve	Oxide film	G. E.	Siemens-Martin steel	5/16	1	No. 4 galvanised	Bell and private	162
Sleeve	Oxide film	G. E.	Siemens-Martin steel	5/16	1	No. 6 Cu.	Bell	163
Sleeve			Siemens-Martin steel	5/16	1	No. 6 Cu.	Bell	164
Sleeve			Siemens-Martin steel	5/16	1	No. 6 W. P.	Bell	165
Sleeve	Oxide film	G. E.	Siemens-Martin steel	3/8	1	No. 6 W. P.	None	166
Sleeve	Oxide film	G. E.	Siemens-Martin steel	5/16	1	5/16" S.-M.	Bell and private	167
Sleeve	Oxide film	G. E.	Siemens-Martin steel	3/8	2	No. 6 W. P.	Private and Bell	168
Sleeve	Oxide film	G. E.	Siemens-Martin steel	3/8	1		Private and Bell	169
Sleeve	Oxide film	G. E.	Siemens-Martin steel	5/16	1	No. 6 Cu.	Private and Bell	170
							None	
Twist sleeve	Oxide film	G. E.					Leased telephone	171
Twist sleeve	Oxide film	G. E.					Leased telephone	172
Twist sleeve	Oxide film	G. E.	Steel strand	5/16	1		Leased telephone; carrier	173
McIntyre sleeve No. 527	Oxide film	G. E.					Leased telephone	174
Double barrel twist sleeve	Aluminum cell; oxide film	G. E.	Steel strand	3/8	2		Private telephone	175
McIntyre sleeve No. 527	Oxide film	G. E.					Leased telephone	176
3-section sleeve	Oxide film	G. E.					Carrier	177
Double barrel twist sleeve	Oxide film; auto-valve	G.E.; W'hse	Steel strand	3/8	2		Private telephone on leased pin space	178
Cu. sleeve splice	1 e'lytic; 1 auto-valve; 2 ox. film	G.E.; W'hse	Galv. steel strand	3/8	2	Galvanised angle	None along line	179
Sleeve splice	S. V. auto-valve	W'hse				Pipe ground	None along line	180
Sleeve splice	S. V. auto-valve	W'hse					Two wire system	181
Sleeve splice	Oxide film	G. E.				Pipe ground	None along line	182
Cu. sleeve splice	2 oxide film; 3 S. V.	G.E.; W'hse					None along line	183
Sleeve splice	3 electrolytic; 1 S. V.	W'hse				Pipe ground	None along line	184
Cu. sleeve splice	2 S. V.; 4 el ectrolytic; 3 oxide film	W'hse; G.E.	Galv. steel strand	3/8	2	Galvanised angle	None along line	185
Sleeve splice	Electrolytic	W'hse				Pipe ground	Two wire, none along line	186
Cu. sleeve splice	Oxide film	G. E.					None along line	187
Cu. sleeve splice	Oxide film	G. E.					None along line	188
Sleeve splice	Oxide film	G. E.				Pipe ground	None along line	189
Splicing sleeves	Oxide film; auto-valve	G.E.; W'hse					Wisconsin telephone	190

river with this circuit.

e, not included here.

9 kv., 2.5 miles 1—69 kv. and 1—6.9 kv.; double
Melvina line on 69 kv. to Cashton Junction, 2.5

9 kv.
9 kv., 3.5 miles 69 kv. and 13.2 kv.

No. of Line (1)	Region, Name of Company and Terminals of Transmission Line (2)	Year During which Line was Connected (3)	Normal Rating of Line			Steel Towers or Wood Poles (7)	Number of Circuits per Tower Line (8)	Length of Tower Line, Miles (9)	Weigh Tow
			Load Rating per Circuit Kva. (4)	Voltage Kv. (5)	Cycles (6)				
	WEST NORTH CENTRAL								
	Utilities Power & Light Corp. (Interstate Power Co., Del.)								
1	Austin, Minn.—Osage, Ia.	1928	.....	66	60	Wood poles	1	31.4	.....
2	Clinton—Dubuque (Via Illinois Side)	Under construction	.....	66	60	Wood poles	1	70.0	.....
3	Clinton—Dubuque (Via Iowa Side)	1926	.....	66	60	Steel towers	1	54.0	.....
	(Missouri Electric Power Co.)								
4	Crocker—Dixon	Under construction	.....	66	60	Wood poles	1	15.0	.....
5	Crocker—Richland	Under construction	.....	66	60	Wood poles	1	14½	.....
6	Dixon—Newburg	Under construction	.....	66	60	Wood poles	1	15.0	.....
7	Richland—Stoutland	Under construction	.....	66	60	Wood poles	1	7½	.....
8	Lebanon—Phillipsburg	Under construction	.....	66	60	Wood poles	1	15.25	.....
9	Lebanon—Sleeper	Under construction	.....	66	60	Wood poles	1	7½	.....
10	Sleeper—Stoutland	Under construction	.....	66	60	Wood poles	1	6	.....
11	Marshfield—Phillipsburg	Under construction	.....	66	60	Wood poles	1	20.0	.....
	(Interstate Power Co. of Nebraska)								
12	Hartington—O'Neill, Nebraska	1927	.....	66	60	Wood poles	1	90.0	.....
	Mississippi River Power Co.								
13	Alton—Meppen	1914	15,000	66	25	Steel towers	1	28.7	
14	Keokuk—St. Louis	1912	60,000	115	25	Steel towers	2	143.6	
	Iowa Southern Utilities Co.								
15	Grinnell—Ottumwa	1927	7,500	66	60	Wood poles	.....	55.7	.....
16	Oskaloosa—Sigourney	1927	7,500	66	60	Wood poles	.....	23.7	.....
17	Eddyville—Albia	1928	7,500	66	60	Wood poles	.....	14.78	.....
	Des Moines Electric Light Co.								
18	Des Moines—Prairie City	1927	10,000	66	60	Wood poles	1	20.0	.....
19	Prarie City—Oskaloosa	1927	10,000	66	60	Steel towers	1	40.0	2,00
	Missouri Public Service Co.								
20	Clinton—Warrensburg	1928	9,400	66	60	Wood poles	1	29.0	.....
21	Warrensburg—Pleasant Hill	1928	9,400	66	60	Steel towers	1	32.0	.....
	Kansas City Power & Light Co.								
22	Kansas City—Carrollton	1922	5,600	66	60	Wood poles	1	82.0	.....
	Buchanan County Power Transmission Co.								
23	St. Joseph and East Atchison	1926	9,000	66	60	Wood poles	1	16.0	.....
	The Empire District Elec. Co.								
24	Hydro—Plant—Ozark Beach and Joplin	1913	.....	.....	.....	Wood poles	1	120.0	.....
25	Riverton, Kans.—Service, Kans.	1928	25,000	66	60	Steel towers	1 (ult. 2)	28.0	6,000
	The Kansas Power & Light Co.								
26	Tecumseh—2 Miles East of Atchison	1925	10,000	66	60	Steel towers	2	60.0	5,500
	Kansas Utilities Co.								
27	Ft. Scott—Crawford County Line	1926	5,000	66	60	Wood poles	1	15.5	.....
	Northern States Power Co.								
28	No. 6 Stockyards Sub.—Rogers Lake	1923	61,800	110	60	Both	1	5.07 (wood 74)	
29	No. 6 Rogers Lake Sub.—High Bridge Station	1923	61,800	110	60	Steel towers	1	4.20	
30	No. 11 Rogers Lake Sub.—High Bridge Station	1924	61,800	110	60	Steel towers	1	4.21	
31	No. 11 Rogers Lake Sub.—Minnesota River	1924	61,800	110	60	Steel towers	1	2.66	
32	No. 7 Stockyards Sub.—St. Croix River	1923	52,000	110	60	Wood poles	1	11.89	.....
33	No. 4 Long Lake Sub.—Stockyards Sub.	1290	42,800	110	60	Wood poles	1	12.87	.....
34	Oak Park—Twin City Forge	1922	1,800	110	60	Wood poles	1	2.5	.....
35	Wilson—Rogers Lake	1924	36,800	110	60	Steel towers	1	5.0	
36	Aldrich—Wilson	1924	36,800	110	60	Steel towers	1—110, 2—60 kv.	4.2	
37	Aldrich—Wilson	1924	36,800	110	60	Steel towers	1	10.7	
38	Riverside—Aldrich	1924	36,800	110	60	Wood poles	1	10.5	.....
39	Riverside—Aldrich	1924	36,800	110	60	Steel towers	1	3.5	.....
40	Terminal—Riverside	1921	23,800	110	60	Wood poles	1	3.0	.....
41	Terminal—Riverside	1921	23,800	110	60	Steel towers	1	4.0	
42	Oak Park—Terminal	1917	23,800	110	60	Steel towers	1	24.3	
43	Rogers Lake Tap—Hastings	1917	.....	66	60	Wood poles	1	16.6	.....
44	Faribault—Mankato	1912	.....	66	60	Wood poles	2	41.8	.....
45	Northfield—Faribault	1909	.....	66	60	Wood poles	1	15.0	.....
46	Rogers Lake—Northfield	1923	.....	66	60	Steel towers	1	29.5	.....
47	Cannon Falls—Northfield	1910	.....	66	60	Wood poles	1	14.8	.....
48	Cannon Falls—Zumbrota	1912	.....	66	60	Wood poles	1	23.3	.....
49	Red Wing—Cannon Falls	1923	.....	66	60	Wood poles	1	25.6	.....
50	Mankato—Waterville	1912	.....	66	60	Wood poles	1	2.0	.....
51	Mankato—Rapidan	1923 and 1925	.....	66	60	Wood poles	1	11.50	.....
52	Rapidan—St. James	1916	.....	66	60	Wood poles	1	37.80	.....
53	St. James—Mountain Lake	1916	.....	66	60	Wood poles	1	14.50	.....
54	Oil Sw. No. 325—New Ulm River Crossing	1917	.....	66	60	Wood poles	1	36.5	.....
55	Winthrop Junction—Franklin	1917	3,000	63	60	Wood poles	1	26.55	.....
56	Winthrop Junction—New Ulm	1918	3,000	63	60	Wood poles	1	11.2	.....
57	Winthrop—Winthrop Junction	Poles 1924, Cu. 1917	3,000	63	60	Wood poles	2	2.0	.....
58	Young America—Winthrop	1917	5,000	63	60	Wood poles	1	31.2	.....
59	St. Cloud—Coon Rapids	1924	15,000	66	60	Wood poles	1	65.0	.....
	SOUTH ATLANTIC								
	Pennsylvania Water & Power Co.								
1	Holtwood—Baltimore (Circuits Nos. 1 and 2)	1910	16,000 per circ.	70	25	Steel towers	2	40.0	.....
2	Holtwood—Baltimore (Circuits Nos. 5 and 6)	1917, 1914	16,000 per circ.	70	25	Steel towers	2	40.0	.....
3	Holtwood—Coatesville (Circuits Nos. 13 and 14)	1923	20,000 per circ.	70	60	Steel towers	2	29.0	.....
4	Holtwood—Lancaster (Circuits Nos. 15 and 16)	1924	15,000 per circ.	70	60	Steel towers	2	15.0	.....
5	Holtwood—York (Circuits Nos. 11 and 12)	1923	5,000 per circ.	70	60	Steel towers	2	23.0	.....
	The Potomac Edison Co. and Subsidiaries								
6	Williamsport—Cumberland	1924	20,000	66	60	Wood poles	2	53.4	.....
7	Williamsport—Roxbury	1926	10,000	66	60	Wood poles	1	32.8	.....
	Virginia Electric & Power Co.								
8	Richmond—Occoquan	1926, 1928	5,000	66	60	Wood poles	1	82.0	.....
9	Richmond—Petersburg	1910—1913	10,000	110	60	Steel towers	1	25.0	
10	Petersburg—Suffolk	1917—1918	10,000	110	60	Steel towers	1	79.0	.....
11	Suffolk—Norfolk	1923, 1925	30,000	110	60	Steel towers	2	17.0	
12	Suffolk—Roanoke Rapids, N. C.	1925	15,000	110	60	Steel towers	1	63.6	
13	Roanoke Rapids, N. C.—Tarboro, N. C.	1927	5,000	110	60	Wood poles	1	48.6	.....
14	Suffolk—Winfall, N. C.	1927	5,000	110	60	Wood poles	1	35.4	.....
15	Tap—Newton Park, Substation, Norfolk	1927	15,000	110	60	Steel towers	1	6.83	
	Virginia Public Service Co.								
16	Altavista—Balcony Falls	1928	22,500	66	60	Wood poles	1	38.2	.....
17	Altavista—Roanoke Rapids, N. C.	1926	5,300	66	60	Wood poles	1	130.0	.....
18	Charlottesville—Staunton	1925	21,000	66	60	Steel towers	1	40.0	5
19	Charlottesville—Remington	1926	16,000	66	60	Wood poles	1	52.0	.....
20	Goshen—Staunton	1926	28,000	66	60	Steel towers	1	30.0	5
21	Chase City—Crewe	1926	18,900	66	60	Wood poles	1	36.0	.....
22	Halifax—South Boston	1927	.....	66	60	Wood poles	1	6.0	.....
	Monongahela West Penn Public Service Co.								
23	Rivesville—Hutchinson	1919	15,000	66	60	Both	1	11.10	
24	Rivesville—Lake Lynn	1925	30,000	66	60	Steel towers	2	19.30	3,970 (t
25	Rivesville—Grafton	1922	30,000	66	60	Wood poles	1	13.58	.....
26	Grafton—Flemington	1923	30,000	66	60	Wood poles	1	8.23	.....
27	Howesville—Grafton	1923	30,000	66	60	Wood poles	1	19.19	.....
28	Lake Lynn—Howesville	1922	30,000	66	60	Wood poles	1	20.78	.....
29	Howesville—Oakland	1923	Op. at 6.9 kv.	66	60	Wood poles	1	20.14	.....
30	Flemington—Buckhannon	1928	Op. at 22 kv.	66	60	Wood poles	1	19.10	.....
31	Paden—Wheeling (Marshall County Line)	1924	.....	66	60	12 S. T.; 456 W. P.	1	53.45	13
	Duke Power Co.								
32	Various lines	1909—1928	.....	100	60	Steel towers	2	1,070	Suspen
	Columbus Electric & Power Co.								
33	Bartlett's Ferry—Manchester	1925	45,000	110	60	Steel towers	1	29.9	3
34	Junction—Bartlett's Ferry	1926	45,000	110	60	Steel towers	2	1.3	4
35	Columbus—Americus	1927	7,500	110	60	Wood poles	1	63.3	3
36	Goat Rock—West Point	1913	45,000	110	60	Steel towers	1	17.9	2
37	West Point—Gunsets, Ala.	1923	30,000	110	60	Wood poles	1	9.9	.....
38	West Point—Newnan	1913	45,000	110	60	Steel towers	1	42.1	3
39	Newnan—Georgia Power Co. Sub.	1913	45,000	110	60	Steel towers	1	1.2	3
40	Steam Plant—North Highlands Station	1913	40,000	110	60	Steel towers	1	1.3	3
41	North Highlands—Goat Rock	1922	40,000	110	60	Wood poles	1	9.3	.....
	Florida Power Corp.								
42	Dunnellon—Dunnellon Hydro	1927	16,000	66	60	Wood poles	1	9.8	.....
43	Dunnellon Hydro—Inglis Steam Plant	1927	20,000	66	60	Wood poles	1 (ult. 2)	4.5	.....
44	Leesburg—Ocala—High Springs	1927	7,000	66	60	Wood poles	1	96.0	.....
45	Reddick—Williston	1927	5,000	66	60	Wood poles	1	12.0	.....
46	Tarpon Springs—Jasper	1927	18,000	110	60	Steel towers	1 (ult. 2)	177.4	8
	West Florida Power Corp.								
47	Florida—Georgia State Line—White Springs, Florida	1927	10,000	66	60	Wood poles	1	29.7	.....
48	Havana—Tallahassee	1927	7,000	66	60	Wood poles	1	16.7	.....
	Tampa Electric Co.								
49	Winter Haven—Dundee	1927	8,500	66	60	Wood poles	.....	4.5	.....
50	Mulberry—Winter Haven	1926	7,500	66	60	Wood poles	.....	18.7	.....
51	Tampa—Mulberry	1926	18,000	66	60	Wood poles	.....	26.5	.....
52	Tampa—Pinellas County Line	1926	12,000	66	60	Wood poles	.....	18.4	.....
	EAST SOUTH CENTRAL								
	Lexington Utilities Co.								
1	Lexington Power House—Kentucky Utilities Co. Line	1925	7,500	66	60	Steel towers	2	4.0	.....
	Kentucky Utilities Co.								
2	Earlington—Morganfield	1928	10,000	66	60	Steel towers	2	36.6	5,200
3	Earlington—Paducah	1926	5,000	66	60	Steel towers	2	64.5	5,200
4	Paducah—Barlow	1927	14,000	66	60	Wood poles	1	25.2	.....
5	Barlow & Mound City, Ill. (River Crossing)	1928	135,000	66	60	Wood poles	1	5.85	.....
6	Dix Dam—Pineville	1924	6,200	66	60	Wood poes	1	87.5	.....
	Kentucky Hydro Electric Co.								
7	Dix Dam—Lexington	1925	16,000	66	60	Steel towers	2	21.4	5,200
8	Dix Dam—Louisville	1925	5,000	66	60	Steel towers	2	69.0	5,200
	Louisville Gas & Electric Co.								
9	Waterside—Dix River Switching Station	1923	10,000	66	60	Wood poles	1	2.6	.....
10	Waterside Station—Shippingport (Falls Station)	1927	75,000	66	60	Steel towers	1	2.57	12,752

Transmission Line

Structures				Conductors						
Weight of Steel per Tower, Lb. (10)	Number of Towers or Poles per Mile (11)	Type of Tower (12)	Manufacturer of Tower (13)	Material (14)	Cross Section Area, Circular Mils or Guage No. (15)	Spacing, Inches (16)	Clearance to Ground Minimum Feet (17)	Clearance to Towers Minimum Inches (18)	Normal Span Feet (19)	Normal Sag Feet (20)
	19	Wood poles		Aluminum	105,534 No. 0	96	25	10	280	2¼
	13	Wood poles		A.C.S.R.	No. 000	72	22	33	400	6
2,400	7	Rigid	Aermotor	A.C.S.R.	No. 000	108	25	24	750	20
	19	Poles		A.C.S.R.	No. 00	96	25	20	280	2¼
	19	Poles		A.C.S.R.	No. 00	96	25	20	280	2¼
	18	Poles		A.C.S.R.	No. 00	96	25	20	280	2¼
	19	Poles		A.C.S.R.	No. 00	96	25	20	280	2¼
	19	Poles		A.C.S.R.	No. 00	96	25	20	280	2¼
	19			A.C.S.R.	No. 00	96	25	20	280	2¼
	19	Poles		A.C.S.R.	No. 00	96	25	20	280	2¼
	19	Poles		A.C.S.R.	No. 00	96	25	20	280	2¼
	19			A.C.S.R.	No. 0	96	25	20	280	2¼
5,000	13	Square	Riter-Conley	Cu.	133,079	72	25	28	450	15
6,800	6	Square	Riter-Conley	Cu.	300,000	120	30	45	880	18.8
	18			Cu. str.	133,079	96	25	22	300—350	6
	18			Cu. str.	133,079	96	25	22	300—350	6
	18			Cu. str.	133,079	96	25	22	300—350	6
	20			H.d. Cu. str.	133,079	110 hor., 90 vert.	24	24	275	4
2,000; 5,000	8	A. B. Co. A, B, C, K, M, N, S, O	American Bridge	A.C.S.R.	No. 0	144 hor.; 108 vert.	24	36	660	12
	22 (incl. H-frame storm guy)			A.C.S.R.	No. 00	84	31		300	2½
				A.C.S.R.	No. 00	84	31		300	2½
	20		Page-Hill	A.C.S.R.	No. 2/0	84	22		250—300	2—3
	10	Wood pole H-frame		Cu.	133,079	150	25	42	500	13
	35							12 to X-arms		
6,000; 11,000	7½	"A.C." susp., "B.C." str.	American Bridge	Cu.	211,600	132	27	41½	700	23.2
5,500; 10,000	8	4-leg, 16' base	Blaw-Knox	A.C.S.R.	No. 0000	96 min.	18	38	660	16
				A.C.S.R.	No. 000	96	28		263	3
4,270	9	Byllesby standard	Blaw-Knox	Cu. 7 str.	212,000	126	24	33¼	Towers 583	Towers 13
4,270	9	Byllesby standard 51'	Blaw-Knox	Cu. 7 str.	212,000	126	24	33¼	597	14
4,270	9	Byllesby standard 51'	Blaw-Knox	Cu. 7 str.	212,000	126	24	43½	588	16
4,270	8½	Byllesby standard 51'	Blaw-Knox	Cu. 7 str.	212,000	126	24	45½	618	17
	10	H-fixtures, 50, 55 and 60' poles		A.C.S.R.	212,000	152	24	51	518	11
	14½	55' poles		Cu. 7 str.	133,000	120	24	38	364	9
	24			Cu.	3 str. No. 8	90	45	42	300	9.3
4,100	9	4-leg, 51 ft.	Blaw-Knox	Cu.	217,500	127; 126	24.5	58	600	15
6,000	10	4-leg, 74 ft.	Blaw-Knox	Cu.	217,500	120, 120	26	72	550	15
4,100	12	4-leg, 51 ft.	Blaw-Knox	Cu.	217,500	120, 142	26	58	400	7
	17			Cu.	217,500	120, 116	24.5	48	300	4.5
	17	65' small base		Cu.	217,500	Tri. 120, 142	32	60	300	4
	17			Cu.	124,900	126, 116	23.5	48	300	4
4,100	12	4-leg, 51 ft.	Aermotor	Cu.	124,900	126, 126	29	57	460	15
4,100	13	4-leg, 51 ft.	Aermotor	Cu.	124,900	126	26	57	600	15
	21			M.h.d. Cu.	49,500	73	24	28	250	3.5
	20			M.h.d. Cu.	78,750	73	24	28	265	3.5
	20			H.d. Cu.	78,750	73	24	28	275	3.5
	6 6	Galv. steel 51' A-frame	Indust. Eng. & Sales	Aluminum	211,600	108	30	42	800	15
	21			H.d. Cu.	52,600	73	24	28	250	4
	18			Cu.	52,600	70	24	42	265	3.5
	14			M.h.d. Cu.	72,680	73	30	28	380	8
	17			3 No. 6 str. Cu.	78,735	72 between top and bottom; 92 between field and road phase	34	27	310	11
	17			3 No. 6 str. Cu.	78,735		34	27	316	17
	17			3 No. 8 str. Cu.	49,155		29	27	310	11
	17			3 No. 8 str. Cu.	49,155		29	27	310	11
	17			3 No. 9 str. Cu.	39,300		29	27	310	11
	16.25	Single circuit Montana		Cu. 3 No. 8 twisted	49,527	A-61, B-99, C-88	29.4	27	326	4.7
	15.25	Single circuit Montana		Cu. 3 No. 9 twisted	33,016	A-61, B-99, C-88	29.4	27	347	6
	17	Double circuit Montana		Cu. 3 No. 8 twisted	49,527	A-115, B-136, C-184	36.5	27	311	3.5
	17	Single circuit Montana		Cu. 3 No. 8 twisted	49,527	A-61, B-99, C-188	29.4	27	310	5.4
	13			Cu.	115,584	114—120—164	25.5	(Wood pole)	400	8
	10		Milliken	Aluminum 19 str.	300,000	84	25	29	500	17
	10		Blaw-Knox	Aluminum 19 str.	300,000	108	25	45	500	17
	7½		Riter-Conley			120	25	53	700	19
	7½		Riter-Conley	Cu.	133,225	120	25	No. 15, 53; 16, 43	700	19
	7½		Riter-Conley	Cu.	133,225	120	25	53	700	19
	10.5			Aluminum	No. 4/0	96	17		500	7
	15			Aluminum	No. 4/0	84	17		350	3', 4"
	10.85	H-frame 1-circ.		Cu.	133,225	147	25	66	528	12
4,000	9.08	Sq. 1-circuit	Milliken	Cu.	105,625	v. 96; h. 150	23	54	660	15
	93	Tangent, A-frame; others sq. 1 circuit	Archbold-Brady	Cu.	71 mi. No. 0; 8 mi. No. 00	v. 126; h. 192	25	66	600	13
4,650	7.35	Sq. 2-circuit	Milliken	Cu.	133,225	v. 120; h. 199, 247	28	72	750	20
5,000	8.5	Sq. 2-circuit	Blaw-Knox	Cu.	133,225	v. 120; h. 198, 294	25	72	660	12
	10.7	H-frame 1-circuit		Cu.	133,225	147	27	66	500	10
	10.7	H-frame 1-circuit		Cu.	133,225	147	25	66	520	12
5,130	6.15	Sq. 2-circuit	Lehigh	Cu.	133,225	v. 120; h. 228, 276	23	74	900	19
	11			A.C.S.R.	No. 4/0	144	25		500	14
	11			A.C.S.R.	No. 3/0	132	25		500	14
5 tons	7	85' high, 20' sq. base	Blaw-Knox	A.C.S.R.	No. 4/0	120	25	54	800	18
	11			A.C.S.R.	No. 4/0	132	25		500	14
5 tons	7	85' high, 20' sq. base	Blaw-Knox	A.C.S.R.	No. 4/0	120	25	54	800	18
	11			A.C.S.R.	No. 3/0	132	25		500	14
	11			A.C.S.R.	No. 3/0	132	25		500	14
4,830	18	No. 9451 sq. battered; 1-circuit X-arm	Franklin	Str. Cu.	66,660	96	25	36	307.5	7
9,970 (tan —22,000		Sq. battered to lower 66 kv. X-arm	Blaw-Knox	Str. Cu.	211,600	84	25	36	666.7	16.5
	11.5	H-frame wood pole		Cu.	211,600	105	25	48	450	7.32
	10	H-frame wood pole		Cu.	211,600	105	25	48	530	11.5
	10	H-frame wood pole		Cu.	211,600	105	25	48	515	10
	11	H-frame wood pole		Cu.	211,600	105	25	48	480	8.41
	11	H-frame wood pole		Cu.	211,600	105	25	48	475	8
	10	H-frame wood pole		Cu.	105,625	105	25	48	579.7	21.2
13,000	8¾	Sq., battered to lower X-arm		Cu.	211,600	105	25	48	603	8.41
Suspension 4,330	10	Rigid—broad base	Milliken, R.-C., Newport News	Cu. all al. cable & A.C.S.R.	133,225 Cu. or equiv. al.	220 hor.; 120 vert.	25	80	500	8.9
3,000	7	Steel suspension		Cu.	133,100	207	33	72	675	
4,000	8	Steel		Cu.	133,109	202	33	72	740	
3,000	8	Galvanised steel suspension		H.d. Cu.	133,100	145	33	72	645	
2,000	7	Steel		Cu.	133,100	207	33	72	675	
	11	Wood—H-frame		Cu.	133,100	144			500	
3,000	10	Steel		Cu.	105,500	207	33	72	522	
3,000	7	Galvanised steel suspension		H.d. Cu.	133,100	144	33	72	575	
3,000	9	Steel tower		Cu.	133,100	125 and 240	33	72	625	
	17	H-frame		H.d. Cu.	211,600	144	33	72	315	
	14.1			A.C.S.R.	105,534	72	22	18	350	5
	18.65			A.C.S.R.	105,534	72	25	18	350	5
	15.31			A.C.S.R.	105,534	72	25	18	350	5
	15			A.C.S.R.	105,534	72	22	18	350	5
8,183	4.34	Rigid	B.-K., Newport News	A.C.S.R.	211,600	120	22	54	1,300	48
	15.22			A.C.S.R.	105,534	72	22	18	350	5
	16.22			A.C.S.R.	105,534	72	22	18	350	5
	13			A.C.S.R.	105,535	64 hor.; 63 vert.	31		400	2½
	20 ave.			M.h.d. Cu. str.	66,358	108 hor.; 72 vert.	24		300	2½
	20 ave.			M.h.d. Cu. str.	211,600	108	24		300	2½
	23			M.h.d. Cu. str.	133,079	72	24		300	2½
	7		American Bridge	Aluminum	No. 3/0	96	28	96	700	
5,200; 8,820	7.3	Standard A and B	American Bridge	A.C.S.R.	167,805	96; 168 horis.	20	36	750	13.5
5,200; 8,820	6.3	American Bridge A and B	American Bridge	A.C.S.R.	167,805	96	20	36	750	13.5
	18.6	Single wood pole	Creosote Pine	A.C.S.R.	167,805—266,800	120 hor.; 84 vert.	20	36	300	3
	10.2	H-frame wood poles	Creosote Pine	A.C.S.R.	266,800	120	30	36	600	10
	8	H-frame wood poles	Chestnut Poles	A.C.S.R.	266,800	168	20	36	700	8
5,200; 8,820	7	Suspension A and Strain B	American Bridge	A.C.S.R.	167,805	96	20	36	750	13.5
5,200; 8,820	6.8	Suspension A and Strain B	American Bridge	A.C.S.R.	167,805	96	20	36	750	13.5
	42			Cu.	106,000	90 and 72	40	28	125	
12,752; 232,123	5	Special structural	Lakeside Br., Louisville Br.	Cu., Cu.-weld	500,000 or equiv.	198	25	66½	984	45

ransmission Lines in the United States (PAGE 2)

Conductors						Insulation							
							Tangent Line				At Angle Towers		
e to d m	Clearance to Towers Minimum Inches (18)	Normal Span Feet (19)	Normal Sag Feet (20)	Normal Stringing Tension, Lb. (21)	Vertical or Horisontal Arrangement (22)	Normal Volts (23)	No. of Units (24)	Type (25)	Manufacturer (26)	No. of Units (27)	Type (28)	Manufacturer (29)	Ne
	10	280	2¾		Vert. and hori.	66,000	3	Suspension 10"	Westinghouse	4	Strain 10"	Westinghouse	
	33	400	6	250	Vert. and hori.	66,000	4	Suspension	Westinghouse	5	Strain	Westinghouse	
	24	750	20		Horisontal	66,000	4	Suspension 10"	Westinghouse	5	Strain 10"	Westinghouse	
	20	280	2¾		△	66,000	4	Suspension 10"	Thomas	5	Suspension 10"	Westinghouse	
	20	280	2¾		△	66,000	4	Suspension 10"	Westinghouse	5	Suspension 10"	Westinghouse	
	20	280	2¾		△	66,000	4	Suspension 10"	Westinghouse	5	Suspension 10"	Westinghouse	
	20	280	2¾		△	66,000	4	Suspension 10"	Westinghouse	5	Suspension 10"	Westinghouse	
	20	280	2¾		△	66,000	4	Suspension 10"	Westinghouse	5	Suspension 10"	Westinghouse	
	20	280	2¾		△	66,000	4	Suspension 10"	Westinghouse	5	Suspension 10"	Westinghouse	
	20	280	2¾		△	66,000	4	Suspension 10"	Westinghouse	5	Suspension 10"	Westinghouse	
	20	280	2¾		△	66,000	4	Suspension 10"	Westinghouse	5	Suspension 10"	Westinghouse	
	20	280	2¾		△	66,000	3	Suspension 10"	Westinghouse	4	Strain 10"	Westinghouse	
	28	450	15	3,000	Vertical	170,000	6	No. 25,620	Ohio Brass	8	No. 25,620	Ohio Brass	
	45	880	18.8	4,000	Vertical	150,000	9	No. 25,620	Ohio Brass	2x8	No. 25,620	Ohio Brass	
	22	300—350	6	900	△	100,000	5	No. 602	Westinghouse	6	No. 602	Westinghouse	
	22	300—350	6	900	△	100,000	5	No. 602 strain	Westinghouse	6	No. 602 strain	Westinghouse	
	22	300—350	6	900	△	100,000	5	No. 602 strain	Westinghouse	6	No. 602 strain	Westinghouse	
	24	275	4	2,500	▷	66,000	5	No. 25,622	Ohio Brass	6	No. 25,622	Ohio Brass	
	36	660	12	2,250	△	66,000	6	No. 25,622	Ohio Brass	7	No. 25,622	Ohio Brass	
		300	2½	1,200	Vertical	88,000	5	No. 5,800—G-2	Locke	6	No. 5,800—G-2	Locke	Gr
		300	2½	1,200	Vertical	88,000	5	No. 5,800—G-2	Locke	6	No. 5,800—G-2	Locke	Gr
		250—300	2—3	650	▷	66,000	1	No. 12,552 Pin (1)	Ohio Brass	6	No. 25,622 suspension	Ohio Brass	
	42	500	13		Horisontal	240,000	6	No. 8,401 socket suspension	Locke	7	No. 8,401	Locke	
	12 to X-arms				▷	66,000		Pin		6	No. 25,622	Ohio Brass	
	41½	700	23.2	2,150	Vertical	66,000	5	No. 25,620	Ohio Brass	11	No. 26,240 (ult. 132 kv.)	Ohio Brass	
	38	660	16	4,050 max.	Vertical	79,200	6	No. 25,622	Ohio Brass	7	13.2 kv. saucer No. 25,622	Ohio Brass	
		263	3		▷	66,000		Pin No. 12,552	Ohio Brass	4	O. B. No. 25,622	Ohio Brass	
	33¼	Towers 583	Towers 13	Towers 2,100	Towers h.; poles △	110,000	6	Suspension No. 25,622	Ohio Brass	7	Suspension No. 25,622	Ohio Brass	
	33¼	597	14	2,100	Horisontal	110,000	6	Suspension No. 25,622	Ohio Brass	7	Suspension No. 25,622	Ohio Brass	
	43½	588	16	1,800	Horisontal	110,000	7	Suspension No. 2,094	Lapp	8	Suspension No. 2,094	Lapp	
	45½	618	17	1,800	Horisontal	110,000	7	Suspension No. 2,300	Lapp	8	Suspension No. 2,300	Lapp	
	51	518	11	600	Horisontal	110,000	8	Suspension No. 2,094	Lapp	9	Suspension No. 2,094	Lapp	
	38	364	9	750	△	110,000	5	Suspension	Jeffery-Dewitt	6	Suspension	Jeffery-Dewitt	
	42	300	9.3	5,400	Horisontal		5		Jeffery-Dewitt	6		Jeffery-Dewitt	
5	58	600	15	1,000	Horisontal	140,000	7	No. 2,300	Lapp	8	No. 2,300	Lapp	
	72	550	15	1,000	Vertical	140,000	7	No. 2,300	Lapp	8	No. 2,300	Lapp	
	58	400	7	900	Horisontal	140,000	7	No. 2,300	Lapp	8	No. 25,622	Ohio Brass	
5	48	300	4.5	700	△	140,000	7	No. 25,622	Ohio Brass	8	No. 2,094	Lapp	
	60	300	4	700	△	140,000	7	No. 2,094	Lapp	8	A-No. 257	Jeffery-Dewitt	
5	68	300	4		Vert.; hori. and △	132,000	6	A No. 257	Jeffery-Dewitt	7	A-No. 257	Jeffery-Dewitt	
	57	460	15	800	Horisontal	132,000	6	A No. 257	Jeffery-Dewitt	7	A-No. 257	Jeffery-Dewitt	
	57	600	15	800	Horisontal	132,000	6	A No. 257	Jeffery-Dewitt	7	Suspension	Jeffery-Dewitt	
	28	250	3.5	1,000	▷	80,000				3	Suspension	Lapp	
	28	265	3.5	1,000	▷	80,000	1	Pin	Ohio-Brass	5	Suspension	Jeffery-Dewitt	
	28	275	3.5	1,000	▷	80,000				4	Suspension	Ohio Brass	
	42	800	15			80,000				5	Suspension	Jeffery-Dewitt	
	28	250	4	650	▷	80,000	1	Pin	Jeffery-Dewitt	4	Suspension	Ohio Brass	
	42	265	3.5	1,000	▷	80,000				5	Suspension	Lapp	
	28	300	8	600	▷	80,000				4		Ohio Brass	
	27	310	11	3,680	Vertical	360,000	4		Ohio Brass	5		Ohio Brass	
	27	316	17	3,680	Vertical	360,000	4		Ohio Brass	5		Ohio Brass	
	27	310	11	1,590	Vertical	330,000	4		Ohio Brass	5		Ohio Brass	
	27	310	11	1,970	Vertical	360,000	4		Ohio Brass	5		Jeffery-Dewitt	
	27	310	11	1,590	Vertical	330,000	3		Jeffery-Dewitt	4 pole	A-No. 250	Jeffery-Dewitt	
4	27	326	4.7	426	△	100,000	4	No. 25,622	Ohio Brass	4	A-No. 250	Jeffery-Dewitt	
4	27	347	6	300	△	100,000	3	A No. 250	Jeffery-Dewitt	3	No. 25,622; A-No. 250	O. B.; J.-D.	
5	27	311	3.5	518	Vertical	100,000	4	No. 25,622; A No. 250	O. B.; J.-D.	4 or 6		O. B.; J.-D.	
4	27	310	5.4	330	△	100,000	4	Disc or suspension	Ohio Brass	4 J.-D. or 5 O. B.	Disc No. 5,800	Locke	
5	(Wood pole)	400	8		▷		4	Disc No. 5,800	Locke	5			
	29	500	17	550	Vertical	70,000	7	10" suspension 4¾" spacing	Ohio Brass	8	10" suspension 4¾" spacing	Ohio Brass	
	45	500	17	550	Vertical	70,000	7	10" suspension 4¾" spacing	Ohio Brass	8	10" suspension 4¾" spacing	Ohio Brass	
	53	700	19	1,000	Vertical	70,000	7	10" suspension 4¾" spacing	Ohio Brass	8	10" suspension 4¾" spacing	Ohio Brass	
	No. 15, 53; 16, 43	700	19	1,000	Vertical	15 70,000; 16 110,00 0	No. 15 7, 16 9	10" suspension 5¼" spacing	Locke	No. 15 circ. 8	10" suspension 4¾" spacing	Ohio Brass	
	53	700	19	1,000	Vertical	70,000	7	10" suspension 5¼" spacing	Locke	8	10" suspension 5¼" spacing	Locke	R'Tf
		300	7	1,300	Horisontal	120,000	6 and 7	No. 602	Westinghouse	7	No. 602	Westinghouse	
		350	3', 4"	1,300	Horisontal	75,000		Pin No. 86	Pireo	6	J.-D. No. A-254	Jeffery-Dewitt	
	66	528	12	1,250	Horisontal	200,000 wet flash.	5	No. 25,622; 6.41	O. B.; W'hse	6	Suspension	Ohio Brass	
	54	660	15		Vertical	350,000 wet flash.	9	No. 25,622	Ohio Brass	9	Suspension	Ohio Brass	
	66	600	13		Vertical	350,000 wet flash.	9	No. 25,622	Ohio Brass	9	Suspension	Ohio Brass	
	72	750	20		Vertical	350,000 wet flash.	9	No. 25,622	Ohio Brass	9	Suspension	Ohio Brass	
	72	660	12	1,465	Vertical	350,000 wet flash.	9	No. 25,622	Ohio Brass	9	Suspension	Ohio Brass	
	66	500	10	1,175	Horisontal	320,000 wet flash.	8	No. 25,622	Ohio Brass	9	Suspension	Ohio Brass	
	66	520	12	1,250	Horisontal	320,000 wet flash.	8	No. 641	Westinghouse	9	Suspension	Westinghouse	
	74	900	19		Vertical	320,000 wet flash.	8	No. 641	Westinghouse	9	Suspension	Westinghouse	
		500	14	1,400	Horisontal	66,000	5	Hewlett	Thomas	6	Hewlett	Thomas	
		500	14	150	Horisontal	66,000	5	Suspension	Locke	6	Suspension	Locke	
	54	800	18	1,800	Vertical	110,000	8	Suspension	Jeffery-Dewitt	9	Suspension	Jeffery-Dewitt	
		500	14	1,400	Horisontal	66,000	5	Hewlett	Thomas	6	Hewlett	Thomas	
	54	800	18	1,800	Vertical	110,000	8	Hewlett	Thomas	9	Hewlett	Thomas	
		500	14	1,050	Horisontal	66,000	5	Suspension	Locke	6	Suspension	Locke	
		500	14	1,050	Horisontal	66,000	5	Suspension	Locke	6	Suspension	Locke	
	36	307.5	7	313	Vert. and hori.	75,000	5	Suspension disc	Ohio Brass	6	Suspension disc	Ohio Brass	
	36	666.7	16.5	1,950	Vertical	75,000	5	Suspension disc	Locke	6	Suspension disc	Locke	
	48	450	7.32	1,800	Horisontal	75,000	5	Disc	Ohio Brass	6	Disc	Ohio Brass	
	46	530	11.5	1,800	Horisontal	75,000	5	Suspension disc	Ohio Brass	6	Suspension disc	Ohio Brass	
	48	515	10	1,800	Horisontal	88,000	4	Disc	Jeffery-Dewitt	5	Disc	Jeffery-Dewitt	
	48	480	8.41	1,800	Horisontal	88,000	4	Disc	Jeffery-Dewitt	5	Disc	Jeffery-Dewitt	
	46	475	8	1,800	Horisontal	88,000	4	Disc	Jeffery-Dewitt	5	Disc	Jeffery-Dewitt	
	48	579.7	21.2	900	Horisontal	88,000	4	Disc	Jeffery-Dewitt	5	Disc	Jeffery-Dewitt	
	48	603	8.41	1,800	Horisontal	88,000	4	Disc	Jeffery-Dewitt	5	Disc	Jeffery-Dewitt	
	80	500	8.9	1,425		100,000	8	10" disc	All stand. makes	10	10" disc	All std. makes	On su
	72	675			△	110,000	7	10" disc	Western Electric	8	10" disc	Western Elec.	
	72	740			Vertical	110,000	7	10" disc	Locke	8	10" disc	Locke	
	72	645			Horisontal	110,000	7	No. 641	Westinghouse	8	No. 641	Westinghouse	
	72	675			Horisontal	110,000	7	10" disc	Loc.; W'hse; O. B.	8	10" disc	Loc.; O. B.; W'e	
		500				110,000	7	10" disc	Westinghouse	8	10" disc	Westinghouse	
	72	522			△	110,000	7	10" disc	Locke; O. B.	8	10" disc	Locke; O. B.	
	72	575			△	110,000	7	10" disc	Ohio Brass	8	10" disc	Ohio Brass	
	72	625			Horisontal	110,000	7	10" disc	Locke	8	10" disc	Locke	
	72	315			Horisontal	110,000	7	10" disc	Locke	8	10" disc	Locke	
	18	350	5		△	70,000	1	Pin	Ohio Brass	5	10" strain	Ohio Brass	
	18	350	5		△	70,000	1	Pin	Ohio Brass	5	10" strain	Ohio Brass	
	18	350	5		△	70,000	1	Pin	Ohio Brass	5	10" strain	Ohio Brass	
	18	350	5		△	70,000	1	Pin	Ohio Brass	5	10" strain	Ohio Brass	
	54	1,300	48		Vertical	110,000	1 set of 8	Strain insulators	Ohio Brass	2x8	Strain	Ohio Brass	66 kv.
	18	350	5		△	70,000	1	Pin	Ohio Brass	5	10" strain	Ohio Brass	
	18	350	5		△	70,000	1	Pin	Locke	5	10" strain	Locke	
		400	2½	1,200	▷	70,000		Pin	Locke No. 1,070				
		308	2½	1,225	▷	110,000	7	Suspension	Locke No. 5,800	8	Suspension	Locke No. 5,800	
		303	2½	3,500	▷	70,000		Pin	Locke No. 1,070				
		300	2½		▷	66,000		Ohio Brass No. 26,852	Ohio Brass				
	96	700			Vertical	225,000 wet arc	5	No. 5,960	Lapp	6	No. 5,960	Lapp	
	36	750	13.5	1,200	Vertical	220,000 wet arc	5	No. 25,622	Ohio Brass	6	No. 25,622	Ohio Brass	
	36	750	13.5	1,200	Vertical	225,000 wet arc	5	No. 5,960	Lapp	6	No. 5,960	Lapp	
	36	300	3	1,100	Vert. and hori.	225,000 wet arc	5	No. 5,960	Lapp	6	No. 5,960	Lapp	
	36	600	10	2,000	Horisontal	220,000 wet arc	5	No. 25,622	Ohio Brass	6	No. 26,240	Ohio Brass	
	36	700	8	2,500		220,000 wet arc	5	No. 25,622	Ohio Brass	6	No. 25,622	Ohio Brass	
	36	750	13.5	1,200	Vertical	220,000 wet arc	5	No. 25,622	Ohio Brass	6	No. 25,622	Ohio Brass	
	36	750	13.5	1,200		100,000				6	Suspension No. 2,300	Lapp	
	28	125			Vert. and hori.	132,000	11	No. 2,094 vacuum	Lapp	2x11	No. 2,094 vacuum	Lapp	
	66½	984	45	1,000—29,000	Horisontal	120,000	5	Bell	Locke				

	End Insulation		Conductor and Insulator Protection											
	Reduced Near Stations (30)	No. of Units (31)	Arcing Horns, Type (32)	Arcing Rings (33)	Size, Inches Top (34)	Size, Inches Bottom (35)	Conductor Clamps, Type and Size (36)	Splicing Method (37)	Arresters Type (38)	Arresters Manufacturer (39)	Overhead Ground Wire Material (40)	Overhead Ground Wire Size Inches (41)		
	No		None	None				McIntyre						
	No													
	No		Yes	None				Sleeves			None			
	No		None	None			Suspension	McIntyre			None			
	No		None	None			Suspension	McIntyre			None			
	No		None	None			Suspension	McIntyre			None			
	No		None	None			Suspension	Sleeves			None			
	No		None	None			Suspension	Sleeves			None			
	No		None	None			Suspension	Sleeves			None			
	No		None	None			Suspension	Sleeves			None			
	No		None	None			Suspension	Sleeves			None			
	No							Sleeves			None			
	No		None	None			Ohio Brass No. 11,041, 8⅛"	Sleeve compression	Aluminum	G. E.	Copperweld	No. ⅛		
	No		Special design	None			Tri. special, 13½" long	Sleeve compression	Aluminum	G. E.	Round S.-M. steel	½		
	No		None	None			Westinghouse No. 287,548, .528"	Cu. sleeves	Auto-valve	W'hse	None			
	No		None	None			Westinghouse No. 287,548, .528"	Single tube cu. sleeve	Auto-valve	W'hse	None			
	No		None	None			Westinghouse No. 287,548, .528"	Single tube sleeve	Auto-valve	W'hse	None			
	No		None	None			Ohio Brass No. 70,755, .375—.687"	Cu. sleeve on twist joints	Oxide film	G. E.	None			
	No		O. B. clamp No. 11,551 w. horns				Ohio Brass No. 11,551, .313—.687"	2 aluminum sleeves	Oxide film	G. E.	Cu.-Weld; Hi-str. steel	⅝		
Grad. shields			None				No. 13,916—G-Clevis; 9x5, ⅝s"	Aluminum twist joints	At sub., oxide film	G. E.	None			
Grad. shields			None				No. 13,916—G-1-Clevis; 9x5, ⅝s"	Aluminum twist joints	At sub., oxide film	G.E.; W'hse	None			
	No		None	None			No. 702 dead-end, No. 2/0	Sleeves	At sub., oxide film					
			Single end	None			Suspension No. 8,475 Locke	Sleeves	At sub., oxide film	G. E.	S.-M. galv. messenger	⅝s		
	No		Ohio Brass	None			Ohio Brass No. 11,543	Sleeves	Electrolytic	W'hse	S.-M. ex. hi-str. str'd			
	No		Ohio Brass	None			Ohio Brass Nos. 70,756, 11,542; J.-D. special	McIntyre, 4½ turns	Oxide film	G. E.		⅝		
	No		None	None			Suspension strain and semi-strain	Twist sleeve	Oxide film; auto-valve	G.E.; W'hse	None			
	No		None	None			None	Twisting joints	Oxide film	G. E.	None			
	No		None	None			Ohio Brass Nos. 11,542, 11,552	Cu. double tube sleeve	At terminals, oxide film	G. E.	S.-M. stranded steel	⅜		
	No		None	None			Ohio Brass Nos. 11,542, 11,552	Cu. double tube sleeve	At terminals, oxide film	G. E.	S.-M. 7 strand steel	⅜		
	No		None	None			Ohio Brass Nos. 11,542, 11,552	Cu. double tube sleeve	At terminals, oxide film	G. E.	S.-M. 7 strand steel	⅜		
	No		None	None			Lapp; Ohio Brass Nos. 11,542, 512	Cu. double tube sleeve	At Rogers Lake, oxide film	G. E.	S.-M. 7 strand steel	⅜		
	No		None	None			Ohio Brass Nos. 11,542, 11,552	Aluminum double tube sleeve	At stockyards, oxide film	G. E.	S.-M. strand steel	⅜		
	No		None	None			Ohio Brass Nos. 11,542, 11,552	Cu. double tube sleeve	oxide film (L. Lake); el'ytic (St. Yds)	G. E.	S.-M. strand steel	⅜		
	No		None	None			Clevis, 10"	Sleeve	3 electrolytic	G. E.	Cu.	No. 8		
	No		None	None			Lapp	Sleeves	None	None	S.-M. galvanized steel	⅜		
	No		None	None			Lapp	Sleeves	None	None	S.-M. galvanized steel	⅜		
	No		None	None			Lapp	Sleeves	None	None	S.-M. galvanized steel	⅜		
	No		None	None			Ohio Brass	Sleeves	None		S.-M. galvanized steel	⅜		
	No		None	None			Lapp	Sleeves	None		S.-M. galvanized steel	⅜		
	No		None	None			Ohio Brass; Victor	Sleeves	None		S.-M. galvanized steel	⅜		
	No		None	None			Ohio Brass; Victor	Sleeves			S.-M. galvanized steel	⅜		
	No		None	None			Ohio Brass; Victor	Sleeves	None	None	Stranded steel	⅜		
	No		None	None			Suspension, 12"	Sleeves	None		Galvanized iron	¼		
	No		None	None			Suspension, 12"	Sleeves	None		Galvanized iron	⅛		
	No		None	None			Suspension, 12"	Sleeves	None		Galvanized iron	⅛		
	No		None	None			Suspension, 12"	Sleeves	None		Galvanized iron	⅜" 7 str.		
	No		None	None			Suspension, 12"	Sleeves	None		Galvanized iron	¼		
	No		None				Suspension, 12"	Sleeves	None		Galvanized steel	¼		
	No		None	None			Ohio Brass, 6"	Sleeves	None		Galvanized iron	⅜ str.		
	No		None	None			Ohio Brass, 6"	Sleeves	1 set electrolytic	Whse	Str. galvanized iron wire	⅜		
	No		None	None			Ohio Brass, 6"	Sleeves	2 sets electrolytic	Whse	Str. galvanized iron wire	⅜, ⅝s		
	No		None	None			Ohio Brass, 6"	Sleeves	3 sets electrolytic; 2 oxide film	W'hse; G.E.	Str. galvanized iron wire	⅜		
	No		None	None			Thomas, Ohio Brass, 6"	Cu. sleeves	1 set oxide film	G. E.	Str. galvanized iron wire	⅜		
	No		None	None			Victor No. 4,335	Cu. sleeves	1 set electrolytic	Whse	Str. galvanized iron wire	⅜		
	No		None	None			Victor No. 4,335	Cu. sleeves	Franklin; electrolytic	G. E.	Siemens-Martin cable	⅜		
	No		⅜" or ⅜" iron	None			Victor No. 4,335, ⅜ or ⅜"	Cu. sleeves	None		¼" Siemens-Martin	⅜		
	No			None			Victor No. 4,335, 3 No. 8 Cu.	Cu. sleeves	At Winthrop; oxide film	G. E.	¼" Siemens-Martin	⅜		
							Lapp No. 101	Double tube cu. sleeves	At young Amer. ; Winthrop; o. f.	G. E.	¼" Siemens-Martin	⅜		
								Sleeves	Oxide film	G. E.	Siemens-Martin steel	⅜		
	No		None	None			Fraser, 300,000 cm.	Tubular twist sleeve	Electrolytic		S.-M. open hearth steel	⅜		
	No		As furnished with clamps	None			Ohio Brass No. 11,551	Tubular twist sleeve	Electrolytic		S.-M. open hearth steel	⅜		
	No		No. 13, circuit only, ditto				Ohio Brass No. 70,756	Tubular twist sleeve	Oxide film		Copperweld	⅜		
	No		As furnished with clamps	None			Ohio Brass No. 70,756	Tubular twist sleeve	Oxide film		S.-M. open hearth steel	⅜		
R'l'f g'ps—5 un.	5		No. 11 circuit only, ditto	None			Ohio Brass No. 70,756	Tubular twist sleeve	No. 11, gap in series with fuse					
	No													
	No		None						Auto-valve	Whse	None			
									Auto-valve; Oxide film	Whse; G.E.	None			
	No		O. B. assembled with clamp	None			Ohio Brass No. 11,551	Open sleeves	Oxide film	G.E.				
	No		O. B. assembled with clamp	None			Ohio Brass No. 11,549	Open sleeves	Oxide film	G.E.	Extra hi-str. galv. steel	⅜		
	No		O. B. assembled with clamp	None			Ohio Brass No. 11,549	Open sleeves	Oxide film and electrolytic	G.E.	Extra hi-str. galv. steel	⅜		
	No		O. B. assembled with clamp	None			Ohio Brass No. 11,549	Open sleeves	Oxide film	G.E.	Extra hi-str. galv. steel	⅜		
	No		O. B. assembled with clamp	None			Ohio Brass No. 11,549	Open sleeves	Oxide film	G.E.	Extra hi-str. galv. steel	⅜		
	No		O. B. assembled with clamp	None			Ohio Brass No. 11,551	Open sleeves	At sub. oxide film	G.E.				
	No		Whse assembled with clamp	None			Westinghouse No. 494,484	Open sleeves	Oxide film	G.E.				
	No		O. B. assembled with clamp	None			Ohio Brass No. 11,551	Open sleeves	Oxide film	G.E.	S.-M. steel cable galv.	⅜		
			None	None			Thomas strain No. 70,231; special No. 10,093	Twist sleeve joint	Oxide film	G.E.				
	No		None	None			Locke strain No. 11,040; special No. 8,470	Twist sleeve joint	Oxide film	G.E.				
			Yes				O. B. str. 70,231 Alumin. Co. semi-str. 103, Th. susp. 10,093	Twist sleeve joint	At sub. oxide film	G.E.	No. 4/0 copper-clad			
			None	None			Thomas strain No. 70,231, suspension No. 10,093	Twist sleeve joint	Oxide film	G.E.	Copper-clad steel	⅛s		
			Yes	None			O. B. str. 70,231, Alum. Co. semi-str. 103, Th. susp.	Twist sleeve joints	Oxide film	G.E.	No. 4/0 copper-clad			
				None			Locke strain No. 11,040, suspension No. 8,470	Twist sleeve joint	Oxide film	G.E.				
			None	None			Locke strain No. 11,040, suspension No. 8,470	Twist sleeve joint	Oxide film	G.E.				
	No		O. B. No. 11,549 and 11,946 str.	None			Suspension Ohio Brass No. 11,549 strain No. 11,946	Sleeve	At sub., electrolytic	Whse	None			
	No		Hubbard No. 5,770 on dbl. strings	None			Ohio Brass strain No. 11,645, suspension No. 11,551	Sleeves	At sub.; auto-valve; el'ytic; o. f.	W'hse; G.E.	None			
	No		None	None			Suspension Ohio Brass No. 11,551, strain No. 11,645	Cu. sleeves	At sub., electrolytic; oxide film	W'hse; G.E.	None			
	No		None	None			Ohio Brass suspension No. 11,551, strain No. 11,645	Sleeves	At sub., electrolytic; oxide film	W'hse; G.E.	None			
	No		None	None			Ohio Brass suspension No. 11,551, strain No. 11,645	Sleeves	At sub., oxide film	G.E.	None			
	No		None	None			Ohio Brass suspension No. 11,551, strain No. 11,645	Cu. sleeves	At sub., oxide film	G.E.	None			
	No		None	None			Ohio Brass suspension No. 11,551, strain No. 11,645	Sleeves	At sub.		None			
	No		None	None			Ohio Brass suspension No. 11,540, strain No. 11,541	Cu. sleeves	At sub. electrolytic-pellet	G.E.	None			
	No		None	None			Ohio Brass suspension No. 11,551, strain No. 11,645	Cu. sleeves	At sub., auto-valve	G.E.	None			
On susp. twrs.	7		None	None								⅜		
	No		Western Electric	None				Sleeves	Oxide film	G.E.	Steel	⅜		
	No		Locke	None				Sleeves	Oxide film	G.E.	Steel	⅜		
	No		Locke	None			Locke dwg. No. 12,158	Sleeves	Oxide film	G.E.	Steel	⅜		
	No		Ohio Brass	None				Sleeves	Electrolite, oxide film	W'hse; G.E.	Steel	⅜		
	No		Yes	None				Sleeves	Oxide film	G.E.	Steel	⅜		
	No		Locke and Ohio Brass	None					Electrolite, oxide film	W'hse; G.E.	Steel	⅜		
	No		Yes	None				Sleeves	Electrolite, oxide film	G.E.; W'hse	Steel			
	No		Locke	None				Sleeves	Oxide film	G.E.	Steel	⅜		
	No		Locke	None				Sleeves	Oxide film	G.E.	Steel	⅜		
	No							Sleeves	Oxide film	G.E.	None			
	No							Sleeves	Oxide film	G.E.				
	No							Aluminum sleeves	Oxide film; auto-valve	G.E.; Whse	None			
66 kv. p. ty. end			Home made					Sleeves	Auto-valve	Whse				
								Aluminum sleeves	None		None—1 future			
								Aluminum sleeves	Auto-valve	Whse				
								Aluminum sleeves	Auto-valve	Whse				
	No		None	None				Cu. sleeves	Auto-valve	Whse	Siemens-Martin steel	⅜		
	No		None	None			Locke No. 8,462	Cu. sleeves	2 auto-valve; 2 oxide film	Whse; G.E.	Siemens-Martin steel	⅜		
	No		None	None				Cu. sleeves	Auto-valve	Whse	Siemens-Martin steel	⅜		
								Aluminum sleeves	Oxide film	G. E.	None			
	No		None	None			Ohio Brass suspension No. 70,755, strain No. 72,703	McIntyre sleeves	At end, oxide film	G.E.	None			
							Ohio Brass suspension No. 70,755, strain No. 72,703	McIntyre sleeves	Oxide film	G.E.	None			
	No		None	None			Ohio Brass suspension No. 70,755, strain No. 72,703	No. 3/0 McIntyre sleeves	Oxide film	G.E.	None			
	No						Ohio Brass suspension No. 70,730, strain No. 71,091	Compressor joint	Oxide film	G.E.	None			
	No		None	None			Ohio Brass suspension No. 70,730, strain No. 71,091	Compressor joints	Oxide film	G.E.				
							Ohio Brass suspension No. 70,755, strain No. 72,703	McIntyre sleeves	Oxide film	G.E.				
	No		None	None			Ohio Brass suspension No. 70,755, strain No. 72,703	McIntyre sleeves	Oxide film	G.E.	None			
	No		None				Clevice, No. 2—1/0	Graduated sleeve	At sta., oxide film	G. E.	Siemens-Martin galv.	⅝s		
	No		None	None			Crosby, 1.19"	Serve splices and Crosby clamps	Auto-valve	Whse	Copperweld	⅜		
											None			

2)

Insulation													Co
Tangent Line			At Angle Towers		End Insulation		Arcing Horns, Type	Arcing Rings	Size, Inches		Conductor Clamps, Type and Size		
Type (25)	Manufacturer (26)	No. of Units (27)	Type (28)	Manufacturer (29)	Reduced Near Stations (30)	No. of Units (31)	(32)	(33)	Top (34)	Bottom (35)	(36)		Splici
Suspension 10″	Westinghouse	4	Strain 10″	Westinghouse	No		None	None					Mc
Suspension	Westinghouse	5	Strain	Westinghouse	No								
Suspension 10″	Westinghouse	5	Strain 10″	Westinghouse	No		Yes	None					Sl
Suspension 10″	Thomas	5	Suspension 10″	Westinghouse	No		None	None			Suspension		Mc
Suspension 10″	Westinghouse	5	Suspension 10″	Westinghouse	No		None	None			Suspension		Mc
Suspension 10″	Westinghouse	5	Suspension 10″	Westinghouse	No		None	None			Suspension		Mc
Suspension 10″	Westinghouse	5	Suspension 10″	Westinghouse	No		None	None			Suspension		Sl
Suspension 10″	Westinghouse	5	Suspension 10″	Westinghouse	No		None	None			Suspension		Sl
Suspension 10″	Westinghouse	5	Suspension 10″	Westinghouse	No		None	None			Suspension		Sl
Suspension 10″	Westinghouse	5	Suspension 10″	Westinghouse	No		None	None			Suspension		Sl
Suspension 10″	Westinghouse	5	Suspension 10″	Westinghouse	No		None	None			Suspension		Sl
Suspension 10″	Westinghouse	4	Strain 10″	Westinghouse	No								Sl
No. 25,620	Ohio Brass	8	No. 25,620	Ohio Brass	No		None	None			Ohio Brass No. 11,041, 8¼″		Sleeve c
No. 25,620	Ohio Brass	2x8	No. 25,620	Ohio Brass	No		Special design	None			Tri. special, 13½″ long		Sleeve c
No. 602	Westinghouse	6	No. 602	Westinghouse	No		None	None			Westinghouse No. 287,548, .528″		Cu.
No. 602 strain	Westinghouse	6	No. 602 strain	Westinghouse	No		None	None			Westinghouse No. 287,548, .528″		Single tu
No. 602 strain	Westinghouse	6	No. 602 strain	Westinghouse	No		None	None			Westinghouse No. 287,548, .528″		Single t
No. 25,622	Ohio Brass	6	No. 25,622	Ohio Brass	No		None	None			Ohio Brass No. 70,755, .375— .687″		Cu. sleeve
No. 25,622	Ohio Brass	7	No. 25,622	Ohio Brass	No		O. B. damp	No. 11,551 w. horns			Ohio Brass No. 11,551, .313— .687″		2 alumi
No. 5,800—G-2	Locke	6	No. 5,800—G-2	Locke	Grad. shields		None				No. 13,916—G-Clevis; 9x5, ⅝″		Aluminu
No. 5,800—G-2	Locke	6	No. 5,800—G-2	Locke	Grad. shields		None				No. 13,916—G-1-Clevis; 9x5, ⅝″		Aluminu
No. 12,552 Pin (1)	Ohio Brass	6	No. 25,622 suspension	Ohio Brass	No		None	None			No. 702 dead-end, No. 2/0		Sl
8,401 socket suspension	Locke	7	No. 8,401	Locke			Single end	None			Suspension No. 8,475 Locke		Sl
Pin		6	No. 25,622	Ohio Brass	No		Ohio Brass	None			Ohio Brass No. 11,543		Sl
No. 25,620	Ohio Brass	11	No. 26,240 (ult. 132 kv.)	Ohio Brass	No		Ohio Brass	None			Ohio Brass Nos. 70,756, 11,542; J.-D. special		McInty
No. 25,622	Ohio Brass	7	13.2 kv. saucer No. 25,622	Ohio Brass	No		None	None			Suspension strain and semi-strain		Tw
Pin No. 12,552	Ohio Brass	4	O. B. No. 25,622	Ohio Brass	No		None	None			None		Twis
Suspension No. 25,622	Ohio Brass	7	Suspension No. 25,622	Ohio Brass	No		None	None			Ohio Brass Nos. 11,542, 11,552		
Suspension No. 25,622	Ohio Brass	7	Suspension No. 25,622	Ohio Brass	No		None	None			Ohio Brass Nos. 11,542, 11,552		Cu. dou
Suspension No. 2,094	Lapp	8	Suspension No. 2,094	Lapp	No		None	None			Ohio Brass Nos. 11,542, 11,552		Cu. dou
Suspension No. 2,300	Lapp	8	Suspension No. 2,300	Lapp	No		None	None			Ohio Brass Nos. 11,542, 11,552		Cu. dou
Suspension No. 2,094	Lapp	9	Suspension No. 2,094	Lapp	No		None	None			Lapp; Ohio Brass Nos. 11,542, 512		Cu. dou
Suspension	Jeffery-Dewitt	6	Suspension	Jeffery-Dewitt	No		None	None			Ohio Brass Nos. 11,542, 11,552		Aluminum
	Jeffery-Dewitt	6		Jeffery-Dewitt	No		None	None			Ohio Brass Nos. 11,542, 11,552		Cu. dou
No. 2,300	Lapp	8	No. 2,300	Lapp	No		None	None			Clevis, 10″		
No. 2,300	Lapp	8	No. 2,300	Lapp	No		None	None			Lapp		
No. 2,300	Lapp	8	No. 25,622	Ohio Brass	No		None	None			Lapp		
No. 25,622	Ohio Brass	8	No. 2,094	Lapp	No		None	None			Lapp		
No. 2,094	Lapp	8	A-No. 257	Jeffery-Dewitt	No		None	None			Ohio Brass		
A No. 257	Jeffery-Dewitt	7	A-No. 257	Jeffery-Dewitt	No		None	None			Lapp		
A No. 257	Jeffery-Dewitt	7	A-No. 257	Jeffery-Dewitt	No		None				Ohio Brass; Victor		
A No. 257	Jeffery-Dewitt	7	Suspension	Jeffery-Dewitt	No		None				Ohio Brass; Victor		
		3	Suspension	Lapp	No		None	None			Ohio Brass; Victor		
Pin	Ohio-Brass	5	Suspension	Jeffery-Dewitt	No		None	None			Suspension, 12″		
		4	Suspension	Ohio Brass	No		None	None			Suspension, 12″		
		5	Suspension	Jeffery-Dewitt	No		None	None			Suspension, 12″		
Pin	Jeffery-Dewitt	4	Suspension	Ohio Brass	No		None	None			Suspension, 12″		
		5	Suspension	Lapp	No		None	None			Suspension, 12″		
		4		Ohio Brass	No		None				Suspension, 12″		
	Ohio Brass	5		Ohio Brass	No		None				Suspension, 12″		
	Ohio Brass	5		Ohio Brass	No		None	None			Ohio Brass, 6″		
	Ohio Brass	5		Ohio Brass	No		None	None			Ohio Brass, 6″		
	Ohio Brass	5		Jeffery-Dewitt	No		None	None			Ohio Brass, 6″		
	Jeffery-Dewitt	4 pole	A-No. 250	Jeffery-Dewitt	No		None	None			Ohio Brass, 6″		
No. 25,622	Ohio Brass	4	A-No. 250	Jeffery-Dewitt	No		None	None			Thomas, Ohio Brass, 6″		Cu
A No. 250	Jeffery-Dewitt	3	No. 25,622; A-No. 250	O. B.; J.-D.	No		None	None			Victor No. 4,335		Cu
No. 25,622; A No. 250	O. B.; J.-D.	4 or 6		O. B.; J.-D.	No		None	None			Victor No. 4,335		Cu
Disc or suspension	Ohio Brass	4 J.-D. or 5 O. B.	Disc No. 5,800	Locke	No		½″ or ¾″ iron	None			Victor No. 4,335, ¾ or ⅜″		Cu
Disc No. 5,800	Locke	5						None			Victor No. 4,335, 3 No. 8 Cu.		
											Lapp No. 101		Double t
													S
suspension 4¾″ spacing	Ohio Brass	8	10″ suspension 4¾″ spacing	Ohio Brass	No		None	None			Fraser, 300,000 cm.		Tubula
suspension 4¾″ spacing	Ohio Brass	8	10″ suspension 4¾″ spacing	Ohio Brass	No		As furnished with clamps	None			Ohio Brass No. 11,551		Tubula
suspension 4¾″ spacing	Ohio Brass	8	10″ suspension 4¾″ spacing	Ohio Brass	No		No. 13, circuit only, ditto				Ohio Brass No. 70,756		Tubula
suspension 5⅛″ spacing	Locke	No. 15 circ. 8	10″ suspension 4¾″ spacing	Ohio Brass	No		As furnished with clamps	None			Ohio Brass No. 70,756		Tubula
suspension 5⅛″ spacing	Locke	8	10″ suspension 5⅛″ spacing	Locke	R'T'f g'pe—5 un.	5	No. 11 circuit only, ditto	None			Ohio Brass No. 70,756		Tubula
No. 602	Westinghouse	7	No. 602	Westinghouse	No								
Pin No. 86	Pinco	6	J.-D. No. A-254	Jeffery-Dewitt	No		None						
No. 25,622; 6.41	O. B.; W'hse	6	Suspension	Ohio Brass	No		O. B. assembled with clamp	None			Ohio Brass No. 11,551		Ope
No. 25,622	Ohio Brass	9	Suspension	Ohio Brass	No		O. B. assembled with clamp	None			Ohio Brass No. 11,549		Ope
No. 25,622	Ohio Brass	9	Suspension	Ohio Brass	No		O. B. assembled with clamp	None			Ohio Brass No. 11,549		Ope
No. 25,622	Ohio Brass	9	Suspension	Ohio Brass	No		O. B. assembled with clamp	None			Ohio Brass No. 11,549		Ope
No. 25,622	Ohio Brass	9	Suspension	Ohio Brass	No		O. B. assembled with clamp	None			Ohio Brass No. 11,549		Ope
No. 641	Westinghouse	9	Suspension	Westinghouse	No		W'hse assembled with clamp	None			Ohio Brass No. 11,551		Ope
No. 641	Westinghouse	9	Suspension	Westinghouse	No		O. B. assembled with clamp	None			Westinghouse No. 494,484		Ope
											Ohio Brass No. 11,551		Ope
Hewlett	Thomas	6	Hewlett	Thomas									
Suspension	Locke	6	Suspension	Locke	No		None	None			Thomas strain No. 70,231; special No. 10,093		Twist
Suspension	Jeffery-Dewitt	9	Suspension	Jeffery-Dewitt			None	None			Locke strain No. 11,040; special No. 8,470		Twist
Hewlett	Thomas	6	Hewlett	Thomas			Yes				O. B. str. 70,231 Alumin. Co. semi-str. 103, Th. susp. 10,093		Twist
Hewlett	Thomas	9	Hewlett	Thomas			None	None			Thomas strain No. 70,231, suspension No. 10,093		Twist
Suspension	Locke	6	Suspension	Locke			Yes	None			O. B. str. 70,231, Alum. Co. semi-str. 103, Th. susp.		Twist
Suspension	Locke	8	Suspension	Locke				None			Locke strain No. 11,040, suspension No. 8,470		Twist
							None	None			Locke strain No. 11,040, suspension No. 8,470		Twist
Suspension disc	Ohio Brass	6	Suspension disc	Ohio Brass	No		O. B. No. 11,549 and 11,946 str.	None			Suspension Ohio Brass No. 11,549 strain No. 11,946		S
Suspension disc	Locke	6	Suspension disc	Locke	No		Hubbard No. 5,770 on dbl. strings	None			Ohio Brass strain No. 11,645, suspension No. 11,551		S
Disc	Ohio Brass	6	Disc	Ohio Brass	No		None	None			Suspension Ohio Brass No. 11,551, strain No. 11,645		Cu.
Suspension disc	Ohio Brass	6	Suspension disc	Ohio Brass	No		None	None			Ohio Brass suspension No. 11,551, strain No. 11,645		S
Disc	Jeffery-Dewitt	5	Disc	Jeffery-Dewitt	No		None	None			Ohio Brass suspension No. 11,551, strain No. 11,645		S
Disc	Jeffery-Dewitt	5	Disc	Jeffery-Dewitt	No		None	None			Ohio Brass suspension No. 11,551, strain No. 11,645		S
Disc	Jeffery-Dewitt	5	Disc	Jeffery-Dewitt	No		None	None			Ohio Brass suspension No. 11,551, strain No. 11,645		Cu.
Disc	Jeffery-Dewitt	5	Disc	Jeffery-Dewitt	No		None	None			Ohio Brass suspension No. 11,551, strain No. 11,645		S
Disc	Jeffery-Dewitt	5	Disc	Jeffery-Dewitt	No		None	None			Ohio Brass suspension No. 11,540, strain No. 11,541		Cu.
							None	None			Ohio Brass suspension No. 11,551, strain No. 11,645		Cu.
10″ disc	All stand. makes	10	10″ disc	All std. makes	On susp. twrs.	7	None	None					
10″ disc	Western Electric	8	10″ disc	Western Elec.	No		Western Electric	None					S
10″ disc	Locke	8	10″ disc	Locke	No		Locke	None					S
No. 641	Westinghouse	8	No. 641	Westinghouse	No		Locke	None			Locke dwg. No. 12,158		S
10″ disc	Loc.; W'hse; O. B.	8	10″ disc	Loc.; O. B.; W'e	No		Ohio Brass	None					S
10″ disc	Westinghouse	8	10″ disc	Westinghouse	No		Yes	None					S
10″ disc	Locke; O. B.	8	10″ disc	Locke; O. B.	No		Locke and Ohio Brass	None					S
10″ disc	Ohio Brass	8	10″ disc	Ohio Brass	No		Yes	None					
10″ disc	Locke	8	10″ disc	Locke	No		Locke	None					S
10″ disc	Locke	8	10″ disc	Locke	No		Locke	None					S
Pin	Ohio Brass	5	10″ strain	Ohio Brass	No								S
Pin	Ohio Brass	5	10″ strain	Ohio Brass									S
Pin	Ohio Brass	5	10″ strain	Ohio Brass	No								Alumin
Pin	Ohio Brass	5	10″ strain	Ohio Brass	No								S
Strain insulators	Ohio Brass	2x8	Strain	Ohio Brass	66 kv. p. ty. end		Home made						Alumin
Pin	Ohio Brass	5	10″ strain	Ohio Brass									
Pin	Locke	5	10″ strain	Locke									Alumin
													Alumin
Pin	Locke No. 1,070				No		None	None					
Suspension	Locke No. 5,800	8	Suspension	Locke No. 5,800	No		None	None					Cu.
Pin	Locke No. 1,070				No		None	None			Locke No. 8,462		Cu.
Ohio Brass No. 26,852	Ohio Brass				No								Alumin
No. 5,960	Lapp	6	No. 5,960	Lapp	No		None	None			Ohio Brass suspension No. 70,755, strain No. 72,703		McInty
No. 25,622	Ohio Brass	6	No. 25,622	Ohio Brass							Ohio Brass suspension No. 70,755, strain No. 72,703		McInty
No. 5,960	Lapp	6	No. 5,960	Lapp	No		None	None			Ohio Brass suspension No. 70,755, strain No. 72,703		No. 3/0 Mc
No. 5,960	Lapp	6	No. 5,960	Lapp	No						Ohio Brass suspension No. 70,730, strain No. 71,091		Compre
No. 25,622	Ohio Brass	6	No. 26,240	Ohio Brass	No		None	None			Ohio Brass suspension No. 70,730, strain No. 71,091		Compre
No. 25,622	Ohio Brass	6	No. 25,622	Ohio Brass							Ohio Brass suspension No. 70,755, strain No. 72,703		McInty
No. 25,622	Ohio Brass	6	No. 25,622	Ohio Brass	No		None	None			Ohio Brass suspension No. 70,755, strain No. 72,703		McInty
		6	Suspension No. 2,300	Lapp	No		None				Clevice, No. 2—1/0		Gradua
No. 2,094 vacuum	Lapp	2x11	No. 2,094 vacuum	Lapp	No		None	None			Crosby 1-18″		

Conductor and Insulator Protection								
	Arresters		Overhead Ground Wire				Communication System Used	
Splicing Method (37)	Type (38)	Manufacturer (39)	Material (40)	Size Inches (41)	No. Used (42)	Type of Ground Used on Poles or Towers (43)	(44)	No. of Line (1)
McIntyre								1
								2
Sleeves			None				None	3
McIntyre			None				None	4
McIntyre			None					5
McIntyre			None					6
Sleeves			None					7
Sleeves			None					8
Sleeves			None				None	9
Sleeves			None					10
Sleeves			None					11
Sleeves			None					12
Sleeve compression	Aluminum	G. E.	Copperweld	No. 1/0	1	Sherardised rod	Private telephone	13
Sleeve compression	Aluminum	G. E.	Round B.-M. steel	1/2	1	Sherardised rod	Private telephone	14
Cu. sleeves	Auto-valve	W'hse	None				None	15
ngle tube cu. sleeve	Auto-valve	W'hse	None				Long distance telephone	16
Single tube sleeve	Auto-valve	W'hse	None			None	Long distance telephone	17
sleeve on twist joints	Oxide film	G. E.	None				None	18
aluminum sleeves	Oxide film	G. E.	Cu.-Weld; Hi-str. steel	5/8	1		None	19
uminum twist joints	At sub., oxide film	G. E.	None			No. 6 copper-clad	Inter-Company line telephone	20
uminum twist joints	At sub., oxide film	G.E.; W'hse	None			No. 6 copper-clad	Inter-Company line telephone	21
Sleeves	At sub., oxide film							22
Sleeves	At sub., oxide film	G. E.	S.-M. galv. messenger	5/16	2	Copperweld	Carrier current	23
Sleeves	Electrolytic	W'hse	S.-M. ex. hi-str. str'd			No. 6 iron soldered to 1/2"x6' 0" galv. gr. rod	Telephone	24
McIntyre, 4½ turns	Oxide film	G. E.		5/8	1	1¼" galv. pipe with No. 5/8 copper tail	Telephone	25
Twist sleeve	Oxide film; auto-valve	G.E.; W'hse	None			Ground rod on each tower	Carrier current	26
Twisting joints	Oxide film	G. E.	None			No. 4 iron wire	2-wire telephone	27
Cu. double tube sleeve	At terminals, oxide film	G. E.	S.-M. stranded steel	3/8	1	Tower legs extend through concrete into earth	Local telephone service	28
Cu. double tube sleeve	At terminals, oxide film	G. E.	S.-M. 7 strand steel	3/8	1		Local telephone company, to terminals	29
Cu. double tube sleeve	At terminals, oxide film	G. E.	S.-M. 7 strand steel	3/8	1		Local telephone company, to terminals	30
Cu. double tube sleeve	At Rogers Lake, oxide film	G. E.	S.-M. 7 strand steel	3/8	1		Local telephone company to Rogers Lake sub.	31
ninum double tube sleeve	At stockyards, oxide film	G. E.	S.-M. strand steel	3/8	2	No. 4 B. B. galv. wound around pole butt	Local telephone to terminals and booths along line	32
Cu. double tube sleeve	oxide film (L. Lake); electrolytic (St. Yds)	G. E.	S.-M. strand steel	3/8	1	No. 4 B. B. galv. wound around pole butt	Local tele. to terminals and booth, middle of line	33
Sleeve	3 electrolytic	G. E.	Cu.	No. 8	1	No. 6 iron wire	None	34
Sleeves	None	None	S.-M. galvanized steel	3/8	1	None	None	35
Sleeves	None	None	S.-M. galvanized steel	3/8	1	None	None	36
Sleeves	None	None	S.-M. galvanized steel	3/8	1	None		37
Sleeves	None		S.-M. galvanized steel	3/8	1	No. 4 iron wire to butts of pole	None	38
Sleeves	None		S.-M. galvanized steel	3/8	1	None	None	39
Sleeves	None		S.-M. galvanized steel	3/8	1	No. 6 iron to butt of pole	None	40
Sleeves			S.-M. galvanized steel	3/8	1	None	None	41
Sleeves	None	None	Stranded steel	3/8	1	None	None	42
Sleeves	None		Galvanized iron	1/4	1	No. 4 solid iron	Commercial telephone	43
Sleeves	None		Galvanized iron	5/16	1	No. 4 iron B. B. gauge	Trans. tel. on 66 kv. pole line	44
Sleeves	None		Galvanized iron	1/4	1	No. 4 iron B. B. gauge	Trans. tel. on 66 kv. pole line	45
Sleeves	None		Galvanized iron	3/8" 7 str.	1	None	Private tel. on separate pole line	46
Sleeves	None		Galvanized iron	1/4	1	No. 4 iron	Trans. line telephone	47
Sleeves	None		Galvanized steel	1/4	1	No. 4 B. B. iron	Trans. telephone line	48
Sleeves	None		Galvanized iron	3/8 str.	1	No. 4 iron	Commercial telephone	49
Sleeves	1 set electrolytic	W'hse	Str. galvanized iron wire	5/8	1	No. 4 B. B. galv. iron wire	Private telephone	50
Sleeves	2 sets electrolytic	W'hse	Str. galvanized iron wire	5/8, 5/16	1	No. 4 B. B. galv. iron wire	Private telephone	51
Sleeves	3 sets electrolytic; 2 oxide film	W'hse; G.E.	Str. galvanized iron wire	1/4	1	No. 4 B. B. galv. iron	Private telephone	52
Sleeves	1 set oxide film	G. E.	Str. galvanized iron wire	1/4	1	No. 6 B. B. galv. iron	Private telephone	53
Cu. sleeves	1 set electrolytic	W'hse	Str. galvanized iron wire	1/4	1	No. 6 B. B. galv. iron	None	54
Cu. sleeves	Franklin; electrolytic	G. E.	Siemens-Martin cable	1/4	1	Every pole No. 6 B. W. G. iron	Private telephone, 2 No. 10	55
Cu. sleeves	None		1/4" Siemens-Martin	1/4	1	No. 6 B. W. G. iron each pole	None	56
Cu. sleeves	At Winthrop; oxide film	G. E.	1/4" Siemens-Martin	1/4	1	No. 6 B. W. G. iron every pole	Private telephone, 2 No. 10	57
uble tube cu. sleeves	At young Amer.; Winthrep; o. f.	G. E.	1/4" Siemens-Martin	1/4	1	No. 6 B. W. G. iron	Private telephone, 2 No. 10	58
Sleeves	Oxide film	G. E.	Siemens-Martin steel	1/4	1	No. 4 B. B. galv. iron	None	59
Tubular twist sleeve	Electrolytic		S.-M. open hearth steel	3/8	1	Single 3/4" pipe 6' 0" long	4 No. 9 cu. wires and carrier	1
Tubular twist sleeve	Electrolytic		S.-M. open hearth steel	3/8	2	Single 3/4" pipe 6' 0" long	4 No. 9 cu. wires and carrier	2
Tubular twist sleeve	Oxide film		Copperweld	3/8	1	Clusters of pipes about every two miles	Carrier current	3
Tubular twist sleeve	Oxide film		S.-M. open hearth steel	3/8	1		Carrier current	4
Tubular twist sleeve	No. 11, gap in series with fuse					None	Carrier current	5
	Auto-valve	W'hse	None			No. 6 copperweld	Carrier current	6
	Auto-valve; Oxide film	W'hse; G.E.	None			None	None	7
Open sleeves	Oxide film	G. E.					None	8
Open sleeves	Oxide film	G. E.	Extra hi-str. galv. steel	3/8	1	Leg of tower	None	9
Open sleeves	Oxide film and electrolytic	G. E.	Extra hi-str. galv. steel	3/8	1	Leg of tower	None	10
Open sleeves	Oxide film	G. E.	Extra hi-str. galv. steel	3/8	1		None	11
Open sleeves	Oxide film	G. E.	Extra hi-str. galv. steel	3/8	1		None	12
Open sleeves	At sub. oxide film	G. E.			0		None	13
Open sleeves	Oxide film	G. E.			0		None	14
Open sleeves	Oxide film	G. E.	S.-M. steel cable galv.	3/8	1	No. 3/8 standard bare copper (1 per mile)	None	15
Twist sleeve joint	Oxide film	G. E.					None	16
Twist sleeve joint	Oxide film	G. E.					No. 6 Cu.-clad metallic	17
Twist sleeve joint	At sub. oxide film	G. E.	No. 4/0 copper-clad		1		No. 6 Cu.-clad metallic	18
Twist sleeve joint	Oxide film	G. E.	Copper-clad steel	5/16	1	Rods	None	19
Twist sleeve joints	Oxide film	G. E.	No. 4/0 copper-clad		1		No. 6 Cu.-clad metallic	20
Twist sleeve joint	Oxide film	G. E.					No. 6 Cu.-clad metallic	21
Twist sleeve joint	Oxide film	G. E.					Open wire No. 12 E. B. B.	22
Sleeve	At sub., electrolytic	W'hse	None			No. 4/4 ground wire on towers	None	23
Sleeves	At sub.; auto-valve; electrolytic; o. f.	W'hse; G.E.	None			No. 3/8 ground wire	Telephone 2-wire	24
Cu. sleeves	At sub., electrolytic; oxide film	W'hse; G.E.	None			None	2-wire telephone	25
Sleeves	At sub., electrolytic; oxide film	W'hse; G.E.	None			None	2-wire telephone	26
Sleeves	At sub., oxide film	G. E.	None			None	2-wire telephone	27
Cu. sleeves	At sub., oxide film	G. E.	None			None	2-wire telephone	28
Sleeves	At sub.		None			None	2-wire telephone	29
Cu. sleeves	At sub. electrolytic-pellet	G. E.	None			None	None	30
Cu. sleeves	At sub., auto-valve	G. E.	None			None	None	31
				3/8	1	Depend on contact of twr. foot's and earth	Private line on separate pole lines	32
Sleeves	Oxide film	G. E.	Steel	3/8	1	Tower footings	Telephone (metallic circ.)	33
Sleeves	Oxide film	G. E.	Steel	3/8	1	Footings	Telephone (metallic circ.)	34
Sleeves	Oxide film	G. E.	Steel	3/8	1	6 turns about base of pole	Metallic circ. telephone	35
Sleeves	Electrolite, oxide film	W'hse; G.E.	Steel	3/8	1	Tower footings	Telephone (metallic circ.)	36
Sleeves	Oxide film	G. E.	Steel	3/8	1	Wrapped about foot of pole	Telephone	37
	Electrolite, oxide film	W'hse; G.E.	Steel	3/8	1	Tower footings	Telephone (metallic circ.)	38
Sleeves	Electrolite, oxide film	G.E.; W'hse	Steel		1	Tower footings	Telephone	39
Sleeves	Oxide film	G. E.	Steel	3/8	1	Footings	Telephone (metallic circ.)	40
Sleeves	Oxide film	G. E.	Steel	3/8	1	Driven rod	Telephone (metallic circ.)	41
Sleeves	Oxide film	G. E.	None			Galvanized steel wire	Carrier current	42
Sleeves	Oxide film	G. E.				Galvanized steel wire	Telephone circ. under line	43
Aluminum sleeves	Oxide film; auto-valve	G.E.; W'hse	None			Galvanized steel wire	Carrier current	44
Sleeves	Auto-valve	W'hse				Galvanized steel wire	Public telephone	45
Aluminum sleeves	None		None—1 future			None	Carrier current	46
Aluminum sleeves	Auto-valve	W'hse				Galvanized ground wire	Public telephone and carrier current	47
Aluminum sleeves	Auto-valve	W'hse				Galvanized steel wire	Public telephone	48
Cu. sleeves	Auto-valve	W'hse	Siemens-Martin steel	3/8	1	No. 2 solid copper	Metallic circ. No. 6 solid cu.	49
Cu. sleeves	2 auto-valve; 2 oxide film	W'hse; G.E.	Siemens-Martin steel	3/8	1	No. 2 solid copper	Metallic circ. No. 6 copperweld	50
Cu. sleeves	Auto-valve	W'hse	Siemens-Martin steel	3/8	1	No. 2 solid copper	Metallic circ. No. 6 solid copperweld	51
Aluminum sleeves	Oxide film	G. E.	None			No. 6 galvanized iron	Metallic circ. No. 6 copperweld	52
McIntyre sleeves	At end, oxide film	G. E.	None			Towers have earth anchors	Telephone on 33 kv.	1
McIntyre sleeves	Oxide film	G. E.	None				Carrier current	2
3/0 McIntyre sleeves	Oxide film	G. E.	None			None	None	3
Compressor joint	Oxide film	G. E.	None				None	4
Compressor joints	Oxide film	G. E.					Carrier current	5
McIntyre sleeves	Oxide film	G. E.					None	6
McIntyre sleeves	Oxide film	G. E.	None				Carrier current	7
Graduated sleeve	At sta., oxide film	G. E.	Siemens-Martin galv.	5/16	1	20'1¼" driver pipe	50 pair cable	8
ices and Crosby clamps	Auto-valve	W'hse	Copperweld	5/8	2	Driven pipes	None	9
								10

	Tampa Electric Co.									
49	Winter Haven—Dundee	1927	8,560	66	60	Wood poles		4.5		
50	Mulberry—Winter Haven	1926	7,500	66	60	Wood poles		18.7		
51	Tampa—Mulberry	1926	18,000	66	60	Wood poles		26.5		
52	Tampa—Pinellas County Line	1926	12,000	66	60	Wood poles		18.4		
	EAST SOUTH CENTRAL									
	Lexington Utilities Co.									
1	Lexington Power House—Kentucky Utilities Co. Line	1925	7,500	66	60	Steel towers	2	4.0		
	Kentucky Utilities Co.									
2	Earlington—Morganfield	1928	10,000	66	60	Steel towers	2	36.6		5,200
3	Earlington—Paducah	1926	5,000	66	60	Steel towers	2	64.5		5,200
4	Paducah—Barlow	1927	14,000	66	60	Wood poles	1	25.2		
5	Barlow & Mound City, Ill. (River Crossing)	1928	135,000	66	60	Wood poles	1	5.85		
6	Dix Dam—Pineville	1924	6,200	66	60	Wood poss	1	87.5		
	Kentucky Hydro Electric Co.									
7	Dix Dam—Lexington	1925	16,000	66	60	Steel towers	2	21.4		5,200
8	Dix Dam—Louisville	1925	5,000	66	60	Steel towers	2	69.0		5,200
	Louisville Gas & Electric Co.									
9	Waterside—Dix River Switching Station	1923	10,000	66	60	Wood poles	1	2.6		
10	Waterside Station—Shippingport (Falls Station)	1927	75,000	66	60	Steel towers	1	2.57		12,752
	Kentucky-Tennessee Light & Power Co.									
11	Bowling Green—Hopkinsville	1924	.....	66	60	Wood poles	1	60.0		
	The Tennessee Electric Power Co.									
12	Isabella—Georgia State Line	1924	.....	66	60	Wood poles	1	3.46		
13	Ducktown Junction—Isabella	1916	.....	66	60	Wood poles	1	2.47		
14	Ridgedale Sub.—Georgia State Line	1924	.....	110	60	Steel towers	1	3.57		2,263
15	Cleveland—Georgia State Line	1912	.....	66	60	Wood poles	1	12.10		
16	Cleveland Junction—Chattanooga (Ridgedale Sub.)	1927	.....	120	60	Wood poles	1	27.98		
17	Ocoee No. 1—Cleveland Junction	1913	.....	120	60	Steel towers	2	11.07		
18	Ocoee No. 1—Cleveland (North)	1913	.....	66	60	Wood poles	1	13.18		
19	Ocoee No. 1—Cleveland (South)	1913	.....	66	60	Wood poles	1	13.18		
20	Cleveland Junction—South Nashville	1913	.....	120	60	Steel towers	1	140.8		
21	Cleveland—Knoxville (Arlington Sub.)	1924	.....	120	60	Steel towers	1	80.46		2,263
22	Knoxville—Coal Creek (Arlington Sub.)	1924	.....	66	60	Steel towers	1	22.43		2,263
23	Coal Creek—Petros	1925	.....	66	60	Wood poles	1	22.56		
24	Coal Creek—Westbourne	1928	.....	66	60	Wood poles	1	21.64		
25	Ocoee No. 1—Knoxville (Arlington Sub.)	1920	.....	120	60	Steel towers	1	82.88		2,364
26	Ocoee No. 2—Ocoee No. 1	1913	.....	66,120	60	Steel towers	2	7.52		
27	Ocoee No. 2—Ducktown Junction	1916	.....	66	60	Steel towers	1	10.66		4,000
28	Ducktown Junction—Copperhill	1916	.....	66	60	Wood poles	1	2.27		
29	Lenoir City—Harriman	1927	.....	66	60	Steel towers	1	21.22		2,761
30	Cleveland—Lenoir City	1912	.....	66	60	Wood poles	1	57.66		
31	Hales Bar—College Junction	1915	.....	120	60	Steel towers	1	36.56		4,000
	Alabama Power Co.									
32	Leeds—Fulton Springs	1923	.....	110	60	Wood poles	1	15.6		
33	Leeds—Red Mountain	1924	.....	110	60	Steel towers	2	10.5		
34	Jackson Shoals—Leeds—Magella	1914	.....	110	60	Steel towers	2	45.2		
35	Lock 12—Leeds	1923	.....	110	60	Wood poles	1	38.6		
36	Lock 12—Magella	1914	.....	110	60	Steel towers	2	46.5		
37	Lock 12—Mitchell Dam	1923	.....	110	60	Steel towers	2	12.2		
38	Lock 12—Anniston	1914	.....	110	60	Steel towers	2	67.76		
39	Anniston—Gadsden	1914	.....	110	60	Steel towers	2	26.0		
40	Gadsden—Georgia State Line	1924	.....	110	60	Wood poles	1	35.6		
41	Gadsden—Huntsville	1923	.....	110	60	Wood poles	1	62.6		
42	Sheffield—Huntsville	1925	.....	110	60	Wood poles	1	71.7		
43	Martin—Leeds	1928	.....	110	60	Steel towers	1	73.8		
44	Gorgas—Sheffield	1918	.....	154	60	Wood poles	1	85.7		
45	Bessemer—Gorgas	1917	.....	110	60	Both	2	25.4		
46	Gorgas—Fulton Springs	1926	.....	110	60	Steel towers	2	23.7		
47	Fulton Springs—Boyles	1928	.....	110	60	Steel towers	2	3.8		
48	Jordon Dam—Martin Dam No. 1	1923	.....	110	60	Wood poles	1	20.6		
49	Jordon Dam—Martin Dam No. 2	1927	.....	110	60	Wood poles	1	21.2		
50	Jordon Dam—Meridian, Miss	1926	.....	110	60	Wood poles	1	151.2		
51	Mitchell Dam—Jordon Dam	1923	.....	110	60	Wood poles	1	18.5		
52	Jordon Dam—Flomaton	1926	.....	110	60	Wood poles	1	130.0		
53	Flomaton—Mobile	1926	.....	110	60	Wood poles	1	55.75		
54	North Auburn—Georgia State Line	1926	.....	110	60	Wood poles	1	40.4		
55	Martin Dam—North Auburn No. 1	1924	.....	110	60	Wood poles	1	27.0		
56	Martin Dam—North Auburn No. 2	1927	.....	110	60	Wood poles	1	26.92		
57	Martin Dam—Tallassee No. 1	1923	.....	110	60	Wood poles	1	7.5		
58	Martin Dam—Tallassee No. 2	1926	.....	110	60	Wood poles	1	7.6		
59	Martin Dam—Anniston—Georgia State Line	1928	.....	110	60	Steel towers	1	116.3		
60	Tallassee—Union Springs	1924	.....	110	60	Wood poles	1	31.0		
61	Union Springs—Newton	1927	.....	110	60	Wood poles	1	53.6		
62	Newton—Graysville	1928	.....	110	60	Steel towers	1	28.0		
	Gulf Power Co.									
63	Flomaton, Ala.—Pensacola, Fla	1926	.....	110	60	Wood poles	1	39.4		
	Mississippi Power Co.									
64	Meridian—Hattiesburg	1926	.....	110	60	Wood poles	1	69.8		
	WEST SOUTH CENTRAL									
	Gulf States Utilities Co.—Louisiana Division									
1	Lake Charles—Lafayette	1926, 1928	10,000	66, 33	60	Wood poles	1—66; 1—33 kv.	71.7		
2	Orange, Texas—Lake Charles, La	1926	10,000	66	60	Wood poles	1	33.4		
	Southwestern Gas & Electric Co.									
3	Ashdown—Dequeen, Ark	1928	10,000	66	60	Wood poles	1	43.0		
4	Bloomburg—Atlanta, Tex	1925	5,000	66	60	Wood towers	1	7.0		
5	Gilliam—Marshall, Tex	1928	15,000	66	60	Wood poles	1	42.0		
6	Marshall—Longview, Tex	1924	4,000	66	60	Wood poles	1	23.0		
7	Shreveport—Gilliam	1925	30,000	66	60	Wood poles	2	22.0		
8	Gilliam—Texarkana	1925	15,000	66	60	Wood poles	1	48.0		
9	Texarkana—Ashdown	1925	10,000	66	60	Wood poles	1	20.0		
10	Longview, Tex.—Big Sandy, Tex	1926	10,000	66	60	Wood poles	.....	25.0		
11	Big Sandy, Tex.—Mineola, Tex	1925	10,000	66	60	Wood poles	1	25.0		
	Public Service Co. of Oklahoma									
12	Hugo—Wright City	1927—1928	.....	66	60	Wood poles	.....	30.5		
13	Okmulgee—Henryetta	1926	.....	66	60	Wood poles	.....	13.0		
14	Henryetta—Weleetka	1927	.....	66	60	Wood poles	.....	28.75		
15	Weleetka—McAlester	1928	.....	66	60	Wood poles	.....	29.0		
16	Weleetka—Oklahoma Gas & Electric Tap	1927	.....	66	60	Wood poles	.....	10.75		
17	Tulsa—Okmulgee	1926—1927	.....	66	60	Wood poles	.....	35.0		
18	Tulsa—West Tulsa	1927	.....	66	60	Wood poles	.....	9.5		
19	Tulsa—Nowata	1925—1926	.....	66	60	Wood poles	.....	55.0		
20	Nowata—Bartlesville	1928	.....	66	60	Wood poles	1	19.4		
	Oklahoma Gas & Electric Co.									
21	Bristow Tap—Bristow	1918	8,000	63	60	Wood poles	1	12.0		
22	Davis—Ardmore	1927	10,000	63	60	Wood poles	1	26.0		
23	Hill Top Tap—Oklahoma Power Co. Junction	1918	20,000	63	60	Wood poles	1	3.0		
24	Garber Tap—Ponca City	1927	17,000	63	60	Wood poles	1	35.0		
25	Ponca City—Kansas State Line	1927	17,000	63	60	Wood poles	1	25.0		
26	Perry—Cushing	1922	10,000	63	60	Wood poles	1	50.0		
27	Enid—Perry	1922	10,000	63	60	Wood poles	1	41.50		
28	Hennessey—Enid	1923	5,000	63	60	Wood poles	1	21.50		
29	Norman—Hennessey	1917	5,000	63	60	Wood poles	1	91.0		
30	Cushing—Drumright	1922	10,000	63	60	Wood poles	1	8.50		
31	Drumright—Horseshoe Lake	1927	18,000	63	60	Wood poles	1	44.50		
32	Oklahoma City—Horseshoe Lake (North Line)	1925	35,000	63	60	Wood poles	1	22.0		
33	Oklahoma City—Horseshoe Lake (South Line)	1925	35,000	63	60	Wood poles	1	23.75		
34	Drumright—Sapulpa (Old Line)	1918	.....	63	60	Wood poles	1	29.50		
35	Drumright—Sapulpa (New Line)	1927	.....	63	60	Wood poles	1	30.0		
36	Sapulpa—Keifer	1918	4,000	63	60	Wood poles	1	6.50		
37	Sapulpa—Muskogee	1924	17,000	63	60	Wood poles	1	31.50		
38	Sapulpa—Sand Springs	1921	25,000	63	60	Wood poles	1	9.75		
39	Sapulpa—Tulsa	1918	20,000	63	60	Wood poles	1	15.0		
40	Little River No. 3—Tyrola Corner	1928	.....	63	60	Wood poles	1	10.0		
41	Seminole Tap—Little River No. 3	1927	.....	63	60	Wood poles	1	7.0		
42	Seminole Tap—Seminole No. 1	1927	.....	63	60	Wood poles	1	6.0		
43	Earlsboro Tap—Seminole No. 1	1928	15,000	63	60	Wood poles	1	12.50		
44	Seminole No. 3—Weleetka—63 Kv. Line	1928	15,000	63	60	Wood poles	1	23.80		
45	Maud Tap—Wewoka	1924	.....	63	60	Wood poles	1	18.75		
46	Harrah—Maud Tap	1928	14,000	63	60	Wood poles	1	47.0		
47	Harrah—Shawnee—Byng	1924	8,000	63	60	Wood poles	1	74.52		
48	Byng—Ada	1923	.....	63	60	Wood poles	1	5.25		
49	Etowah—Pauls Valley	1928	.....	63	60	Wood poles	1	25.98		
50	Sulphur—Pauls Valley	1927	10,000	63	60	Wood poles	1	28.0		
51	Ada—Sulphur	1927	10,000	63	60	Wood poles	1	26.25		
52	Sulphur—Randolph	1928	.....	63	60	Wood poles	1	.....		
53	Muldrow—Poteau	1923	15,000	60	60	Wood poles	1	31.50		
54	Muskogee—Ft. Smith	1922	110,000	63	60	Wood poles	1	78.65		
55	Keifer—Muskogee (Old Line)	1918	4,000	63	60	Wood poles	1	58.50		
	Southwestern Light & Power Co.									
56	Lawton via. Chickasha—Clinton	1927—1928	6,000	66	60	Wood poles	1	121.0		
57	Tipton—Lawton	1923	4,000	66	60	Wood poles	1	51.0		
58	Red River—Frederick	1928	6,000	66	60	Wood poles	1	22.0		
59	Frederick—Manitou Junction	1928	6,000	66	60	Wood poles	1—66; 1—13.2 kv	8½		
	Gulf States Utilities Co. (Tex. Div.)									
60	Beaumont—Sour Lake	1926	10,000	66	60	Wood poles	1	26.38		
61	Beaumont—Orange	1926	20,000	66	60	Wood poles	1	22.7		
62	Orange—La. State Line	1926	15,000	66	60	Wood poles	2	.4		
63	Neches—Dayton—Westbury Sub	1926	2,500	66	60	Wood poles	1	.47		
64	Dayton—Conroe	1928	10,000	66	60	Wood poles	1	46.05		
65	Conroe—Mag. Pumping Plant	1928	10,000	66	60	Wood poles	1	2.44		
	Western Public Service Co.									
66	Dayton—Huffman	1927	10,000	66	60	Wood poles	1	10.43		
67	Sour Lake—Dayton	1925	10,000	66	60	Wood poles	1	44.59		
68	Neches—Dayton—Saratoga Sub	1925	2,500	66	60	Wood poles	1	4.25		
69	Neches—Dayton—South Liberty Sub	1925	2,500	66	60	Wood poles	1	3.0		
70	Neches—Dayton—Hull Sub	1926	2,500	66	60	Wood poles	1	.49		
	Texas—Louisiana Power Co.									
71	Ft. Stockton—Sirvin Line	1928	3,000	66	60	Wood poles	1	35.0		
	Central Power & Light Co.									
72	Lake City—Bay City	1926	10,000	66	60	Wood poles	1	18.0		
73	Bay City—Blessing	1928	5,000	66	60	Wood pole	1	16.0		
74	Uvalde—Val Verde Co. Line	1928	18,000	66	60	Wood poles	1	142.0		
75	Sabinal—Uvalde	1927	20,000	66	60	Wood poles	1	23.0		
76	Carrizo Springs—Uvalde	1928	20,000	66	60	Wood poles	1	52.0		
77	Lissie—Weimer	1926—1927	10,000	66	60	Wood poles	1	42.0		
78	Weimer—Luling	1927	20,000	66	60	Wood poles	1	44.0		
79	Dilley—Asherton	1927	10,000	66	60	Wood poles	1	45.0		
80	Asherton—Carrizo Springs	1926	10,000	66	60	Wood poles	1	8.0		
81	Cuero—Harwood	1926—1927	8,000	66	60	Wood poles	1	41.0		
82	Victoria—Cuero	1923	20,000	66	60	Wood poles	1	28.0		
83	Sinton—Robstown	1924	4,700	66	60	Wood poles	1	23.0		
84	Sinton—Taft	1927	12,000	66	60	Wood poles	1	10.0		
85	Victoria—Beeville—Sinton	1927	20,000	66	60	Wood poles	1	83.0		
86	Edna—Victoria	1926	8,000	66	60	Wood poles	1	29.0		
87	Pierce—Edna	1926	8,000	66	60	Wood poles	1	33.0		
	San Antonio Public Service Co.									
88	McQueeney—Luling	1928	20,000	66	60	Wood poles	1	20.0		
89	New Braunfels—McQueeney	1926	21,000	60	60	Wood poles	1	13.2		
90	New Braunfels—Ditthinger	1927	26,000	60	60	Wood poles	1	1.63		
91	New Braunfels—Spanish Pass	1926	8,000	60	60	Wood poles	1	40.9		
92	New Braunfels—Hunter	.....	15,000	60	60	Wood poles	1	10.10		
93	San Antonio—New Braunfels No. 1	1925	16,000	76	60	Wood poles	1	32.0		
94	San Antonio—New Braunfels No. 2	1927	20,000	76	60	Wood poles	1	28.5		
95	San Antonio—Floresville	1927	10,000	66	60	Wood poles	1	28.5		
96	San Antonio—Sabinal	1926	3,000	66	60	Wood poles	1	67.6		
97	Sabinal Line—Pleasanton Metering Station	1926	2,000	66	60	Wood poles	1	7.2		
	West Texas Utilities Co.									
98	Big Lake—Osona	1927	.....	66	60	Wood poles	1	38.0		
99	Childress—Shamrock	1928	.....	66	60	Wood poles	1	56.0		
100	Childress—Kirkland	1928	.....	66	60	Wood poles	1	16.0		
101	Kirkland—Quanah	1928	.....	66	60	Wood poles	1	15.0		
102	Quanah—Throckmorton	1927	.....	66	60	Wood poles	1	97.0		
103	Throckmorton—Putman	1927	.....	66	60	Wood poles	1	81.0		
104	Quanah—Chillicothe	1928	.....	66	60	Wood poles	1	16.0		
105	Chillicothe—Vernon	1927	.....	66	60	Wood poles	1	14.0		
106	Vernon—Red River	1928	.....	66	60	Wood poles	1	8.0		
107	Vernon—Electra	1927	.....	66	60	Wood poles	1	8.0		

	13			A.C.S.R.	105,535	64 hor.; 63 vert.	31		400	2½	
	20 ave.			M.h.d. Cu. str.	66,358	108 hor.; 72 vert.	24		300	2½	
	20 ave.			M.h.d. Cu. str.	211,600	108	24		300	2½	
	23			M.h.d. Cu. str.	133,079	72	24		300	2½	
	7		American Bridge	Aluminum	No. 3/0	96	28	96	700		
5,200; 8,820	7.3	Standard A and B	American Bridge	A.C.S.R.	167,805	96; 168 horis.	20	36	750	13.5	
5,200; 8,820	6.3	American Bridge A and B	American Bridge	A.C.S.R.	167,805	96	20	36	750	13.5	
	18.6	Single wood pole	Creosote Pine	A.C.S.R.	167,805—266,800	120 hor.; 84 vert.	20	36	300	3	
	10.2	H-frame wood poles	Creosote Pine	A.C.S.R.	266,800	120	30	36	600	10	
	8	H-frame wood poles	Chestnut Poles	A.C.S.R.	266,800	168	20	36	700	8	
5,200; 8,820	7	Suspension A and Strain B	American Bridge	A.C.S.R.	167,805	96	20	36	750	13.5	
5,200; 8,820	6.8	Suspension A and Strain B	American Bridge	A.C.S.R.	167,805	96	20	36	750	13.5	
	42			Cu.	106,000	90 and 72	40	28	125		
12,752; 232,123	5	Special structural	Lakeside Br., Louisville Br.	Cu., Cu.-weld	500,000 or equiv.	198	25	66⅔	984	45	
	21			Cu.	No. 2/0				250		
	12.4			Cu.	105,500	64	20	36	415	8.7	
	28.8	Wood pole with wishbone arm		Cu.	105,500	72 vert., 96 hor.	20	30	184	2.7	
2,263; 6,168	19.5	Flexible A frames; rigid sq.	Blaw-Knox	Cu.	211,600	132 vert., 244 diag.	20	48	314	5.6	
	31.6	Wood pole with wishbone arm		Cu.	105,500	72 vert., 96 hor.	20	30	165	3.5	
	11.1	2-wood pole structure		Cu.	167,800	156	20	38	480	11.3	
3,730	9.05	Galvanized rigid square	Milliken	Cu.	133,100; 167,800	120	20	36	585	17.2	No. 2/0
	31.3	Wood pole with wishbone arm		Cu.	105,500	120	20	30	170	2.02	
	31.3	Wood pole with wishbone arm		Cu.	105,500	72 vert., 96 hor.	20	30	170	2.02	
3,297	7.8	Galvanized rigid square	American Bridge	Cu.	133,100	126	20	36	674	23.5	
2,263; 6,168	10.17	Flexible H-frames; rigid square	Arch.-Br., B.-K.	A.C.S.R.; Cu.	211,600; 133,100 Cu.	132 vert., 240 diag.	20	38	528	11.3;	13.7
2,263; 6,168	10	Flexible A-frame; rigid square	Blaw-Knox	Cu.	133,100	132 vert., 244 diag.	20	38	528	13.8	
	22	Wood pole with wood arm		A.C.S.R.	133,072	74	20		248	3.2	
	8.7	Double wood pole with wood arms		A.C.S.R.	133,079	120	20	30	728	19.1	
2,364; 4,713	12	Flexible A-frame; rigid square	Archbold-Brady	A.C.S.R.; Al.	211,600; 400,000 Al.	132 vert., 192 diag.	20	38	431	7.5;	10.7
3,730	7.7	Galvanized rigid square	Milliken	Cu.	133,100	120	20	36	673	23.5	
4,000; 6,860	7.1	Double circuit rigid square	American Bridge	Cu.	133,100	126	20	38	740	28.1	
	15	Double pole structures		Cu.	105,500	96	20	36	352	61	
2,761; 5,244	8.06	Flexible A-frames; rigid square	Blaw-Knox	A.C.S.R.	133,079	132 vert., 226 diag.	20	30	652	14.3	
	21	Wood pole with wishbone arm		Cu.	133,100	72 vert., 86 hor.	20	30	259	3.2	
4,000; 6,860	11.72	Double circuit rigid square	American Bridge	Aluminum	400,000	126	20	38	453	9	
				Cu.	No. 2/0	184	25	42			
4,400		Broad base double circuit	American Bridge	Cu.	No. 2/0	120	25	42			
	8.2	Broad base double circuit	American Bridge	Cu.	No. 2/0	120	25	42	640		
				A.C.S.R.	397,500	168	25	42			
	7.4	Broad base double circuit	American Bridge	Cu.	No. 2/0	120	25	42	715		
		Broad base double circuit	American Bridge	Cu.	350,000	120	25	42			
	8.2	Broad base double circuit	American Bridge	Cu.	No. 2/0	120	25	42	640		
	7.9	Broad base double circuit	Milliken	Cu.	No. 2/0	108	25	40	670		
	8	H-frame		A.C.S.R.	No. 2/0	168	25	40	650		
	8.8	H-frame		A.C.S.R.	No. 1/0	168	25	40	600		
	7.8			Cu.	300,000	204	25		680		
5,323	5.3	Narrow base flexible	American Bridge	A.C.S.R.	397,500	234	25		1,000		
				Cu.	250,000	168	25	42			
	8	Double circuit		Cu.	No. 2/0	120	25	40			
7,750	5.5	Double circuit	Nashville Bridge	Cu.	250,000	120	25	42	950		
	7.1	Double circuit self support	American Bridge	Cu.	No. 4/0	168	25		740		
	8			A.C.S.R.	397,500	168	25	42	660		
	6.7			A.C.S.R.	397,500	168	25	42	790		
	5.9			A.C.S.R.	397,500	168	25	42	890		
	7.9			A.C.S.R.	397,500	168	25	42	670		
	6.2			A.C.S.R.	397,500	168	25	42	850		
	7	H-frame		Cu.	250,000	204	25	42	773		
	6.35			A.C.S.R.	397,500	168	25		830		
	6.75			A.C.S.R.	No. 4/0	168	25	42	780		
	6.4			A.C.S.R.	397,500	204	25		825		
	6.8			A.C.S.R.	397,500	168	25	42	780		
	6.3			A.C.S.R.	397,500	168	25	42	840		
5,323	5.3	Narrow base flexible	American Bridge	A.C.S.R.	397,500	234	25		1,000		
	8.6			A.C.S.R.	No. 2/0	168	52	42	611		
	6			A.C.S.R.	397,500	168	25	42	880		
4,133	5.5	Narrow base flexible	Nashville Bridge	A.C.S.R.	No. 4/0	168	25	42	970		
	6.3	H-frame		A.C.S.R.	No. 4/0	204	25	42	842		
	6.8			A.C.S.R	No. 4/0	168	25	42	680		
	18	Single pole creosoted pine		Cu.	211,600	84	28.5	42	300	2.25	
	9	H-frames; 2 creosoted pine		Cu.	211,600	174	38	42	600	8.25	
	9	H-frame, 50′ poles, 20′ arm		A.C.S.R.	No. 4/0	120	22	48	600	11	
	9	H-frame, 50′ poles, 20′ arm		A.C.S.R.	No. 2/0	114	22	48	600	10	
	9	H-frame, 50′ poles, 21′ arm		A.C.S.R.	266,800	120	22	48	600	13	
	18	B type, single pole		A.C.S.R.	No. 1/0	108	22	48	300	4	
	9	H-frame, 50′ poles, 29′ arm		A.C.S.R.	266,800	156	22	60	600	13	
	9	H-frame, 50′ poles, 29′ arm		A.C.S.R.	266,800	156	22	72	600	13	
	9	Frame 50′ pole, 20′ arm		A.C.S.R.	No. 4/0	114	22	48	600	10	
	18	Ridge pin single pole		A.C.S.R.	No. 4/0	108	22	48	300	5	
	9	H-frame 50′ pole, 20′ arm		A.C.S.R.	No. 4/0	108	22	48	600	11	
	9.6			A.C.S.R.	211,600	120	25		550	9.5	
	9			A.C.S.R.	211,600	120	24		600	11	
	9.6			A.C.S.R.	266,800	120	24		550	9.5	
	9.6			A.C.S.R.	266,800	168	24		550	9.5	
	19			A.C.S.R.	266,800	108	24		300	3	
	9			A.C.S.R.	266,800	168	24		600	11	
	21			A.C.S.R.	211,600	108	25		250	2	
	9			A.C.S.R.	211,600—167,805	114	22		600		
	9.6			A.C.S.R.	211,600	120	25		550	9	
	21			H.d. Cu. str.	No. 3	44		36	250		
	18			M.h.d. Cu. str.	No. 1/0	72		47	300		
	16			A.C.S.R.	No. 1	72		39	300		
	9			H.d. Cu. 7 str.	No. 2/0	108		53	600		
	18			H.d. Cu. str.	No. 2/0	72		47	300		
	18			M.h.d. Cu. str.	No. 3/0	72		47	300		
	18			M.h.d. Cu. str.	No. 3/0	72		47	300		
	15			Cu.	No. 3/0	72		39	325		
	16			Cu.	No. 4	72		39	350		
	18			M.h.d. Cu. str.	No. 3/0	72		47	300		
	9			M.h.d. Cu. 7 str.	No. 3/0	108		53	600		
	18			M.h.d. Cu. str.	No. 3/0	72		47	300		
	18			M.h.d. Cu. str.	No. 3/0	72		47	300		
	16			H.d. Cu.	No. 3/0	72		39	350		
	9			Cu.	No. 3/0	108		53	600		
	16			H.d. Cu. str.	No. 3	72		43	350		
	9			M.h.d. Cu. str.	No. 3/0	96		47	600		
	16			Cu.	No. 3	70		39	350		
	15			Cu.	No. 3	72		35.2	325		
	18			H.d. Cu. str.	No. 2/0	72		44	300		
	18			H.d. Cu. str.	No. 3	72		47	300		
	18			A.C.S.R.	No. 1	72		39	300		
	21			H.d. Cu. str.	No. 1	72		47	250	3	
	18			H.d. Cu.	No. 3/0	72		47	300		
	18			Cu.	No. 1	72		47	300		
	18			Cu. 7 str.	No. 3/0	72		47	300		
	18			M.h.d. Cu. str.	No. 1/0	72		47	300		
	18			M.h.d. Cu. str.	No. 1/0	72		47	300		
	18			H.d. Cu.	No. 3/0	72		48	300		
	18			Cu.	No. 2	72		39	300		
	8			A.C.S.R.	No. 3/0	108		53	700		
	9			H.d. Cu.	No. 3/0	132		65	600		
	18			M.h.d. Cu. str.	No. 1/0	72		47	300		
	18			M.h.d. Cu. str.	No. 3/0	72		47	300		
	16			M.h.d. Cu.	No. 3	96		47	325		
	10	H-frame wood poles		A.C.S.R.	211,600	120	20	28	525	10.2	
	15	Single pole wood		A.C.S.R.	105,534	96	19	28	350	7	
	10	H-frame		A.C.S.R.	211,600	130	20	28	525	10.2	
	15	Single pole		A.C.S.R.	211,600	108	20	28	350	6	
	20	Single wood pole		Cu.	133,077	108 hor., 84 vert.	40	20	300	6	
	10	H-frame wood poles		Cu.	211,600	174	40	50	600	13	
	20	Single wood pole		Cu.	211,600	84	40	20	300	6	
	18	Single wood pole		Cu.	66,358	108 hor., 84 vert.	40	20	300	6	
	10	H-frame wood poles		A.C.S.R.	211,600	126	20	32	650	11	
	20	H-frame wood poles		A.C.S.R.	211,600	126	20	32	650	11	
	20	H-frame wood poles		A.C.S.R.	133,077	126	20	32	550	11	
	20	Single pole		Cu.	133,077	108 hor., 84 vert.	40	20	300	6	
	18	Single pole		Cu.	66,358	108 hor., 84 vert.	40	20	300	6	
	18	Single pole		Cu.	66,358	108 hor., 84 vert.	40	20	300	6	
	18	Single pole		Cu.	66,358	108 hor., 84 vert.	40	20	300	6	
	9			A.C.S.R.	No. 1/0	116	26	48	600	9	
	14	Single pole, double arm	Texas Creosote	Aluminum	133,100	108	22	54	375	4	
	17	Two-arm	Texas Creosote	Aluminum	133,100	108	22	54	300	4	
	9	H-frame	Texas Creosote	Aluminum	211,600	168	22	84	600	10	
	17	Two-arm	Texas Creosote	Aluminum	211,600	108	22	54	300	3	
	9	H-frame and 2-arm	Texas Creosote	Aluminum	211,600	120	22	60	600	10	
	9	H-frame	Texas Creosote	Aluminum	133,100	120	22	60	600	11	
	9	H-frame	Texas Creosote	Aluminum	211,600	120	22	60	600	11	
	14	Single pole 2-arm	Texas Creosote	Aluminum	133,100	108	22	54	375	4	
	14	Flat arm	Texas Creosote	Aluminum	133,100	54	22	16	375	4	
	9	H-frame	Texas Creosote	Aluminum	133,100	120	22	60	600	11	
	9	H-frame	Texas Creosote	Aluminum	211,600	120	22	60	600	11	
	12	Flat-arm	Texas Creosote	Aluminum	66,300	54	22	16	440	12	
	14	2-arm	Texas Creosote	Aluminum	133,100	108	22	54	375	4	
	9	H-frame	Texas Creosote	Aluminum	211,600	168	22	84	600	9	
	9	H-frame	Texas Creosote	Aluminum	133,100	120	22	60	600	11	
	12	H-frame and flat arm	Texas Creosote	Aluminum	133,100	54	22	16	440	5	
	9	H-frame		A.C.S.R.	No. 4/0	168	35	40	600	10	
	9—18	H-frame single pole		A.C.S.R.	No. 2/0 (.1045 sq. in.)	84	37	36	300	3	
	18	H-frame single pole		A.C.S.R.	No. 1/0 (.0829 sq. in.)	84	37 cen. of sp.	3	300—600	3	
	9	H-frame		A.C.S.R.	No. 2/0 (.1045 sq. in.)	168	30	60	600	12	
	10	H-frame		A.C.S.R.	No. 4/0 (.1662 sq. in.)	168	30	60	600	12	
	9	H-frame		A.C.S.R.	No. 4/0 (.1662 sq. in.)	168 flat	35 cen. of sp.	60	600	10	
	9	H-frame		A.C.S.R.	No. 4/0 (.1662 sq. in.)	168	35 cen. of sp.	60	600	10	
	18	Single pole		A.C.S.R.	No. 1/0 (.0829 sq. in.)	96 hor., 84 vert.	27	36	300	3	
	18			A.C.S.R.	No. 1/0 (.0829 sq. in.)	96 hor., 84 vert.	37	36	300	3	
	18	Single pole		A.C.S.R.	No. 1/0 (.0829 sq. in.)				300		
	8½	H-frame 29 foot cross-arms		A.C.S.R.	No. 4/0	168	22	84	600	11	
	8½	H-frame 29 foot cross-arms		A.C.S.R.	No. 2/0	168	22	84	600	12	
	26	45 foot creosoted poles		A.C.S.R.	No. 2/0	108 hor., 84 vert.	25	49	200	2	
	14	50 foot creosoted pine poles		A.C.S.R.	No. 2/0	108 hor., 84 vert.	25	49	375	4	
	8½	H-frame 14 foot centers 29 foot cross-arms		A.C.S.R.	No. 4/0	168	22	84	600	10—11	
	17½	Single creosoted pine poles		A.C.S.R.	No. 4/0		22	49		2½	
	8½	H-frame 29 foot cross-arms		A.C.S.R.	No. 4/0	168	22	84	600	10	
	17½	50 foot creosoted pine poles		A.C.S.R.	No. 2/0	108 hor., 84 vert.	22	49	300	3	
	8	H-frame 22 foot cross-arms 12 foot spacing		Aluminum	No. 4/0	132	22	61	550	12	

	400	2½	1,200	Δ	70,000		Pin	Locke No. 1,070				
	300	2½	1,225	Δ	110,000	7	Suspension	Locke No. 5,800	8	Suspension	Locke No. 5,800	
	300	2½	3,500	Δ	70,000		Pin	Locke No. 1,070				
	300	2½		Δ	66,000		Ohio Brass No. 26,852	Ohio Brass				
96	700			Vertical	225,000 wet arc	5	No. 5,960	Lapp	6	No. 5,960	Lapp	
36	750	13.5	1,200	Vertical	220,000 wet arc	5	No. 25,622	Ohio Brass	6	No. 25,622	Ohio Brass	
36	750	13.5	1,200	Vertical	225,000 wet arc	5	No. 5,960	Lapp	6	No. 5,960	Lapp	
36	300	3	1,100	Vert. and hori.	225,000 wet arc	5	No. 5,960	Lapp	6	No. 5,960	Lapp	
36	600	10	2,000	Horizontal	220,000 wet arc	5	No. 25,622	Ohio Brass	6	No. 26,240	Ohio Brass	
36	700	8	2,500		220,000 wet arc	5	No. 25,622	Ohio Brass	6	No. 25,622	Ohio Brass	
36	750	13.5	1,200	Vertical	220,000 wet arc	5	No. 25,622	Ohio Brass	6	No. 25,622	Ohio Brass	
36	750	13.5	1,200		100,000				6	Suspension No. 2,300	Lapp	
28	125			Vert. and hori.	132,000	11	No. 2,094 vacuum	Lapp	2x11	No. 2,094 vacuum	Lapp	
66½	984	45	1,000—29,000	Horizontal	120,000	5	Bell	Locke				
	250			Vertical	66,000	5	No. 10,566	Ohio Brass	5	No. 10,566	Ohio Brass	
36	415	8.7	816	Horizontal	66,000	5	10" No. 10,566	Ohio Brass	5	10" No. 10,566	Ohio Brass	
30	184	2.7	535	Δ	110,000	7	10" No. 25,622	Ohio Brass	9	10" No. 25,622	Ohio Brass	
48	314	5.6	1,435	Δ	66,000	5	10" No. 10,756	Ohio Brass	6	10" No. 10,756	Ohio Brass	
30	165	3.5	535	Δ	120,000	8	10" No. 25,622	Ohio Brass	9	10" No. 25,620	Ohio Brass	
38	480	11.3	1,300	Horizontal	120,000	8	10" No. 25,622	Ohio Brass	9	10" No. 25,622	Ohio Brass	
36	585	17.2 No. 2/0	1,000; 1,300	Vertical	66,000	5	10" No. 10,566	Ohio Brass	6	10" No. 10,566	Ohio Brass	
30	170	2.02	460	Δ	66,000	5	10" No. 10,566	Ohio Brass	6	10" No. 10,566	Ohio Brass	
30	170	2.02	460	Δ	120,000	8	10" No. 25,622	Ohio Brass	9	10" No. 25,622	Ohio Brass	
36	674	23.5	990	Horizontal	120,000	8	10" No. 25,622	Ohio Brass	9	10" No. 25,622	Ohio Brass	
38	528	11.3; 13.7	920; 1,000	Δ	66,000	5	10" No. 25,622	Ohio Brass	9	10"	Ohio Brass	
38	528	13.8	100	Δ	66,000	1	66 kv. Pin	Ohio Brass	2	Pin	Ohio Brass	
	248	3.2	445	Δ	66,000	5	10" No. 25,622	Ohio Brass	6	10" No. 25,622	Ohio Brass	
30	728	19.1	650	Horizontal	120,000	8	10" No. 25,622	Ohio Brass	9	10" No. 25,622	Ohio Brass	
38	431	7.5; 10.7	920; 795		66,000 & 120,000	5 & 8	10" No. 25,622	Ohio Brass	6 & 9	10" No. 25,622	Ohio Brass	
36	673	23.5	1,000	Vertical	66,000	7	10" No. 10,566	Ohio Brass	8	10" No. 10,566	Ohio Brass	
38	740	28.1	990	Vertical	66,000	5	No. 10,566	Ohio Brass	5	No. 10,566	Ohio Brass	
36	352	61	816	Horizontal	66,000	5	10" No. 25,622	Ohio Brass	6	10" No. 25,622	Ohio Brass	
30	652	14.3	692	Δ	66,000	5	10" No. 25,622	Ohio Brass	6	10" No. 25,622	Ohio Brass	
30	259	3.2	1,065	Δ	120,000	8	10" No. 25,622	Ohio Brass	9	10" No. 25,620	Ohio Brass	
38	453	9	1,030	Vertical	13,200	5	Suspension	Ohio Brass	5	Suspension	Ohio Brass	
42				Horizontal	110,000	7	No. 25,622	Ohio Brass	9	No. 25,622	Ohio Brass	
42				Vertical	110,000	7	No. 25,622	Ohio Brass	8	No. 25,622	Ohio Brass	
42	640			Vertical	110,000	7		Locke; O. B.	8		Locke; O. B.	
42				Horizontal	110,000	7	Hewlett	Thomas	8	Cap and pin	Ohio Brass	
42	715			Vertical	110,000	7	A	Ohio Brass	8	A	Ohio Brass	
42				Vertical	110,000	7	Cap and pin	Ohio Brass	8	Cap and pin	Ohio Brass	
42	640			Vertical	110,000	7	Cap and pin; Hewlett	O. B.; Thomas	8	Cap and pin	Ohio Brass	
40	670			Vertical	110,000	7	Cap and pin	Thomas	8	Cap and pin	Thomas	
40	650			Horizontal	110,000	6 & 7		J.-D.; O. B.	7 & 8		J.-D.; O. B.	
40	600			Horizontal	110,000	7	B. & S.	Ohio Brass	8		Ohio Brass	
	680			Horizontal	110,000	7	Cap and pin	O. B.; J.-D.	12	Cap and pin	O. B.; J.-D.	
	1,000		7,500	Horizontal	154,000	11	Cap and pin; Hewlett	O. B.; Thomas	12	Cap and pin; Hewlett	O. B.; Thomas	
42				Horizontal	154,000	10	No. 25,620	Ohio Brass	12	No. 25,620	Ohio Brass	
40				Vertical	110,000	7	B. & S.	Ohio Brass	8	B. & S.	Ohio Brass	
42	950			Vertical	110,000	7	No. 5,800	Locke	8	No. 5,800	Locke	
	740			Vertical	110,000	8	No. 25,620	Ohio Brass	9	No. 25,620	Ohio Brass	
42	660		6,050	Horizontal	110,000	7	No. 5,800	Locke	8	No. 5,800	Locke	
42	790			Horizontal	110,000	8	No. 5,800	Locke	9	No. 5,800	Locke	
42	890		5,215	Horizontal	110,000	8	Cap and pin	O. B.; Loc.; Lapp	9	Cap and pin	O. B.; Locke; W 'e	
42	670			Horizontal	110,000	7	Hewlett	Thomas	8	Cap and pin	Ohio Brass	
42	850		5,215	Horizontal	110,000	8	No. 5,800	Locke	9	No. 5,800	Locke	
42	773		4,900	Horizontal	110,000	8	No. 5,800	Locke	9	No. 5,800	Locke	
	836		6,000	Horizontal	110,000	8	No. 5,800	Locke	12	No. 5,800	Locke	
42	780			Horizontal	110,000	7	Cap and pin	Locke	8	Cap and pin	Locke	
	825		6,000	Horizontal	110,000	7	No. 5,800	Locke	12	No. 5,800	Locke	
42	780			Horizontal	110,000	7	Cap and pin	Locke	8	Cap and pin	Locke	
42	840		6,000	Horizontal	110,000	7	No. 5,800	Locke	8	No. 5,800	Locke	
	1,000		7,500	Horizontal	154,000	10 and 11	No. 29,500; A-257	J.-D.; O. B.	11 and 12	No. 29,500 A-257	J.-D.; O. B.	
42	611			Horizontal	110,000	7	Cap and pin	Ohio Brass	8	Cap and pin	Ohio Brass	
42	880		5,215	Horizontal	110,000	7 and 8	J.-D.; Hewlett	J.-D.; Thomas	8 and 9	J.-D.; Hewlett	J.-D ; Thomas	
42	970		4,200	Horizontal	110,000	8	Cap and pin	O. B.; Locke	9	Cap and pin	O. B.; Locke	
42	842		3,200	Horizontal								
42	680											
42	300	2.25	3,200	Vertical	280,000 dry arc	5	Susp. porcel. sock. No. 8,400	Locke	6	Susp. porcel. sock. No. 8,400	Locke	
42	600	8.25	3,650	Horizontal	280,000 dry arc	5						
48	600	11	1,000	Horizontal	66,000	5	10" suspension disc	Ohio Brass	6	10" suspension disc	Ohio Brass	
48	600	10	800	Horizontal	66,000	5	10" suspension disc	Westinghouse	6	10" suspension disc	Westinghouse	
48	600	13	1,300		66,000	5	10" suspension disc	Westinghouse	6	10" suspension disc	Westinghouse	
48	300	4	600	Horizontal	66,000	5	10" suspension disc	Westinghouse	6	10" suspension disc	Westinghouse	
60	600	13	1,300	Horizontal	66,000	5	10" suspension disc socket	Ohio Brass	6	10" suspension disc socket	Ohio Brass	
72	600	13	1,300		66,000	5	10" disc	Ohio Brass				
48	600	10	1,000		66,000	6	10" suspension disc	Westinghouse	6	10" suspension disc	Westinghouse	
48	300	5	700	Horizontal	66,000	1	Pin; O. B. No. 122,552	Ohio Brass	6	10" suspension disc	Ohio Brass	
48	600	11	1,000	Horizontal	66,000	5	10" suspension disc	Ohio Brass	6	10" suspension disc	Ohio Brass	
	550	9.5	1,365	Horizontal		5	10" disc, cap and pin	Lapp; O. B.	6	10" disc cap and pin	Lapp; O. B.	
	600	11	1,400	Horizontal		5	10" disc, cap and pin	Lapp	6	10" disc cap and pin	Lapp	
	550	9.5	1,365	Horizontal		5	10" disc, cap and pin	Lapp	6	10" disc cap and pin	Lapp	
	550	9.5	1,365	Horizontal		5	10" disc, cap and pin	Ohio Brass	6	10" disc cap and pin	Ohio Brass	
	300	3	1,285	2-arm construction		5	10" disc, cap and pin	Ohio Brass	6	10" disc cap and pin	Ohio Brass	
	600	11	1,400	Horizontal		5	10" disc, cap and pin	Lapp, Locke	6	10" disc cap and pin	Lapp; Locke	
	250	2	1,150	2-arm construction		5	10" disc, cap and pin	Ohio Brass	6	10" disc cap and pin	Ohio Brass	
	600		1,260—950	Horizontal		5	10" disc, cap and pin	Locke	6	10" disc cap and pin	Locke	
	550	9	1,230	Horizontal		5	10" disc	Lapp	6	10" disc	Lapp	
36	250			Δ		1	Pin No. 12,552	Ohio Brass	1	Pin No. 12,552	Ohio Brass	
47	300			Δ		4	No. A-257	Jeffery-Dewitt	5	No. A-257	Jeffery-Dewitt	
39	300			Δ		4	No. 25,622	Ohio Brass	5	No. 25,622	Ohio-Brass	
53	600			Horizontal		4	No. A-257	Jeffery-Dewitt	5	No. A-257	Jeffery-Dewitt	
47	300			Δ		4	No. A-257	Jeffery-Dewitt	5	No. A-257	Jeffery-Dewitt	
47	300			Δ		4	No. 25,622	Ohio Brass	5	No. 25,622	Ohio Brass	
47	300			Δ		4	No. 9,004	Locke, Hewlett	5	No. 9,004	Locke, Hewlett	
39	325			Horizontal		4	No. 25,622	Ohio Brass	5	No. 25,622	Ohio Brass	
39	350			Δ		4	No. 25,622	Ohio Brass	5	No. 25,622	Ohio Brass	
47	300			Δ		4	No. 9,004	Locke, Hewlett	5	No. 9,004	Locke; Hewlett	
53	600			Horizontal		5	No. 5,800	Locke	6	No. 5,800	Locke	
47	300			Δ		4	No. 25,622	Ohio Brass	5	No. 25,622	Ohio Brass	
47	300			Δ		4	No. 25,622	Ohio Brass	5	No. 25,622	Ohio Brass	
39	350			Δ		4	No. 25,622	Ohio Brass	5	No. 25,622	Ohio Brass	
53	600			Horizontal		5	No. 5,800	Locke	6	No. 5,800	Locke	
43	350			Δ		3	No. A-257	Jeffery-Dewitt	4		Jeffery-Dewitt	
47	600			Horizontal		4	No. 25,622	Ohio Brass	5	No. 25,622	Ohio Brass	
39	350			Δ		5	No. A-257	Jeffery-Dewitt	4	No. A-257	Jeffery-Dewitt	
35.2	325			Δ		4	No. 25,622	Ohio Brass	5	No. 25,622	Ohio Brass	
44	300			Horizontal		4	No. A-257	Jeffery-Dewitt	5	No. A-257	Jeffery-Dewitt	
47	300			Δ		4	No. A-257	Jeffery-Dewitt	5	No. A-257	Jeffery-Dewitt	
39	300			Δ		4	No. A-257	Jeffery-Dewitt	5	No. A-257	Jeffery-Dewitt	
47	250	3		Δ		4	No. A-257	Jeffery-Dewitt	5	No. A-257	Jeffery-Dewitt	
47	300			Δ		5	No. A-257	Jeffery-Dewitt	6	No. A-257	Jeffery-Dewitt	
47	300			Δ		4	No. A-257	Jeffery-Dewitt	5	No. A-257	Jeffery-Dewitt	
47	300			Δ		5	No. A-257	Jeffery-Dewitt	6	No. A-257	Jeffery-Dewitt	
47	300			Δ		4	No. A-257	Jeffery-Dewitt	5	No. A-257	Jeffery-Dewitt	
47	300			Δ		4	No. A-257	Jeffery-Dewitt	5	No. A-257	Jeffery-Dewitt	
48	300			Δ		4	No. 5,800	Locke	5	No. 5,800	Locke	
39	300			Δ		4	No. A-257	Jeffery-Dewitt	5	No. A-257	Jeffery-Dewitt	
53	700			Horizontal		4	No. A-257	Jeffery-Dewitt	5	No. A-257	Jeffery-Dewitt	
65	600			Horizontal		6	No. 5,800	Locke	7	No. 5,800	Locke	
47	300			Δ		4	No. 25,622	Ohio Brass	5	No. 25,622	Ohio Brass	
47	300			Δ		4	No. 25,622	Ohio Brass	5	No. 25,622	Ohio Brass	
47	325			Horizontal		4	No. 25,622	Ohio Brass	5	No. 25,622	Ohio Brass	
28	525	10.2	3,820	Horizontal	88,000	5	Suspension	Westinghouse	6	Suspension	Westinghouse	
28	350	7	3,600	Vertical	70,000	4	Suspension	Westinghouse	5	Suspension	Westinghouse	
28	525	10.2	3,820	Horizontal	88,000	5	Suspension	Westinghouse	6	Suspension	Westinghouse	
28	350	6	3,320	Vertical	88,000	5	Suspension	Westinghouse	6	Suspension	Westinghouse	
20	300	6	1,500	Δ	66,000	6	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	
50	600	13	3,000	Horizontal	66,000	6	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	
20	300	6	1,500	Vertical	66,000	6	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	
20	300	6	700	Δ	66,000	6	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	
32	650	11	1,350	Horizontal	66,000	6	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	
32	650	11	1,340	Horizontal	66,000	6	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	
32	550	11	1,200	Horizontal	66,000	6	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	
20	300	6	1,500	Δ	66,000	6	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	
20	300	6	700	Δ	66,000	6	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	
20	300	6	700	Δ	66,000	6	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	
20	300	6	700	Δ	66,000	6	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	
48	600	9	800			4	Suspension No. 26,731	Ohio Brass	5	Suspension	Ohio Brass	
54	375	4	900	Horizontal	66,000	5	10" suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	
54	300	4	900	Horizontal	66,000	5	10" suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	
84	600	10	1,400	Horizontal	66,000	5	10" suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	
54	300	3	1,400	Horizontal	66,000	5	10" suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	
60	600	10	1,400	Horizontal	66,000	5	10" suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	
60	600	11	700	Horizontal	66,000	5	10" suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	
60	600	11	700	Horizontal	66,000	5	10" suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	
54	375	4	900	Horizontal	66,000	5	10" suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	
16	375	4	900	Horizontal	66,000	1	Pin 66 Kv.	Graybar	6	Suspension disc 10"	Ohio Brass	
60	600	11	700	Horizontal	66,000	5	10" suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	
60	600	11	700	Horizontal	66,000	5	10" suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	
16	440	12	900	Horizontal	66,000	1	Pin	Graybar Elec.	6	Suspension disc 10"	Ohio Brass	
54	375	4	900	Horizontal	66,000	5	10" suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	
84	600	9	1,400	Horizontal	66,000	5	10" suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	
60	600	11	700	Horizontal	66,000	5	10" suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	
16	440	5	900	Horizontal	66,000	1	Pin	Graybar	6	Suspension disc 10"	Ohio Brass	
40	600	10	1,350	Horizontal	66,000	5	Tho. No. 11,069; No. A-257	Thomas, J-D.	6	Suspension	Thomas; J.-D.	
36	300	3	800	Vertical	66,000	5	Suspension cap and ball	Ohio Brass	6	Suspension cap and ball	Ohio Brass	
of sp. 3	300—600	3	650	Vertical	66,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension cap and ball	Ohio Brass	
60	600	12	700	Horizontal	66,000	5	Suspension cap and ball	Ohio Brass	6	Suspension cap and ball	Ohio Brass	
60	600	12	1,350		66,000	5	Suspension cap and ball	Ohio Brass	6	Suspension cap and ball	Ohio Brass	
of sp. 60	600	10	1,350	Horizontal	76,000	6	Suspension No. 25,622	Ohio Brass	2x10	Suspension No. 25,622	Ohio Brass	
of sp. 60	600	10	1,350	Horizontal	76,000	6	Suspension No. 25,622	Ohio Brass	10	Suspension No. 25,522	Ohio Brass	St
36	300	3	650	Δ	66,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension cap and ball	Ohio Brass	
36	300	3	650		66,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension cap and ball	Ohio Brass	
	300		650		66,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension cap and ball	Ohio Brass	
84	600	11	850	Horizontal	72,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	
84	600	12	600—700	Horizontal	72,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	
49	200	2			66,000	1	Pin No. 12,552	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	
49	375	4			72,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	
84	600	10—11	900		72,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio Brass	
49		2½	900	Δ	72,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio Brass	
84	600	10	900		72,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio Brass	
49	300	3	600		72,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	
61	550	12	800		66,000	5	Suspension No. 35,622		6	Suspension		
60	600	12	600	Horizontal	72,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio Brass	

No		None	None			Cu. sleeves	Auto-valve	W'hse	Siemens-Martin steel			⅜
No		None	None		Locke No. 8,462	Cu. sleeves	2 auto-valve; 2 oxide film	W'hse; G.E.	Siemens-Martin steel			⅜
No		None	None			Cu. sleeves	Auto-valve	W'hse	Siemens-Martin steel			⅜
No						Aluminum sleeves	Oxide film	G. E.	None			
No		None	None		Ohio Brass suspension No. 70,755, strain No. 72,703	McIntyre sleeves	At end, oxide film	G. E.	None			
					Ohio Brass suspension No. 70,735, strain No. 72,703	McIntyre sleeves	Oxide film	G. E.	None			
No		None	None		Ohio Brass suspension No. 70,735, strain No. 72,703	No. 3/0 McIntyre sleeves	Oxide film	G. E.	None			
No					Ohio Brass suspension No. 70,730, strain No. 71,091	Compressor joint	Oxide film	G. E.	None			
No		None	None		Ohio Brass suspension No. 70,730, strain No. 71,091	Compressor joints	Oxide film	G. E.				
					Ohio Brass suspension No. 70,735, strain No. 72,703	McIntyre sleeves	Oxide film	G. E.				
No		None	None		Ohio Brass suspension No. 70,735, strain No. 72,703	McIntyre sleeves	Oxide film	G. E.	None			
No		None			Clevice, No. 2—1/0	Graduated sleeve	At sta., oxide film	G. E.	Siemens-Martin galv.			5/16
No		None	None		Crosby, 1.19"	Serve splices and Crosby clamps	Auto-valve	W'hse	Copperweld			⅝
									None			
No		Bottom only; O. B. 15"	None		Ohio Brass No. 11,548	McIntyre sleeves			Cu.		No. 1/0	
No		Bottom only; O. B. 15"	None		Ohio Brass No. 11,548	McIntyre sleeves			Cu.		No. 1/0	
No		Bottom only; O. B. 15"	None		Ohio Brass Nos. 70,731, 11,542	McIntyre sleeves			S.-M. galv. steel		⅜	
No		Bottom only; O. B. 15"	None		Ohio Brass Nos. 10,879, 10,755	McIntyre sleeves			Cu. clad		No. 1	
No		Bottom only; 15"	None		Ohio Brass Nos. 70,731, 11,542	McIntyre sleeves			None			
No		Bottom only; O. B. 15"	None		Ohio Brass Nos. 10,879, 10,755	McIntyre sleeves			None			
No		None	None		Ohio Brass Nos. 10,879, 10,755	McIntyre sleeves			S.-M. h. s. galv. steel		¼	
No		None	None		Ohio Brass Nos. 10,879, 10,755	McIntyre sleeves			S.-M. h. s. galv. steel		¼	
No		Bottom only; O. B. 15"	None		Ohio Brass Nos. 10,879, 10,755	McIntyre sleeves			S.-M. galv. steel		⅜	
No		Bottom only; O. B. 15"	None		Ohio Brass Nos. 70,731, 71,091	McIntyre sleeves			S.-M. galv. steel		⅜	
No		Bottom only; O. B. 15"	None		Ohio Brass Nos. 11,551, 11,949	McIntyre sleeves			S.-M. galv. steel		⅜	
No		None	None		None				None			
No		Bottom only; O. B. 15"	None		Ohio Brass Nos. 11,551, 70,722	McIntyre sleeves			None			
No		Bottom only; O. B. 15"	None		Ohio Brass Nos. 70,731, 11,542	McIntyre sleeves			S.-M. h. s. galv. steel		⅜	
No		Bottom only; O. B. 15"	None		Ohio Brass Nos. 10,879, 10,755	McIntyre sleeves			S.-M. galv. steel.		5/16	
No		Bottom only; O. B. 15"	None		Ohio Brass No. 11,548	McIntyre sleeves			S.-M. galv. steel		⅜	
No		Bottom only; O. B. 15"			Ohio Brass No. 11,548	McIntyre sleeves			S.-M. galv. steel		⅜	
No		Bottom only; O. B. 15"	None		Ohio Brass No. 70,756, 70,722	McIntyre sleeves			S.-M. h. s. galv. steel		⅜	
No		Bottom only; O. B. 15"	None		Ohio Brass Nos. 10,879, 10,755	McIntyre sleeves			S.-M. galv. steel			
		Bottom only; O. B. 15"	None		Ohio Brass Nos. 70,731, 11,542	McIntyre sleeves			S.-M. galv. steel		⅜	
No		None	None		Aluminum, No. 3/0	Aluminum sleeves	None		None			
No		None	None			Twist sleeve			Steel		⅜	
No						Twist sleeve			Steel		⅜	
No		None	None			Twist sleeve			Steel		⅜	
		Bottom special				Compression joint			Steel		½	
No						Twist sleeve			Steel		⅜	
No						Twist sleeve			Steel		⅜	
No						Twist sleeve			Steel		⅜	
						Twist sleeve			Steel		⅜	
No		None	None			Twist sleeve			Steel		⅜	
No		None	None			Twist sleeve			Steel		⅜	
						Twist sleeve			Steel		⅜	
Yes	8		Yes	24x30	24x40	Compression joint			Compos. al. steel		No. 2/0	
No		None	None			Twist sleeve			Steel		⅜	
No		None	None			Sleeves			Steel		⅜	
No		None	None			Twist sleeves			Steel		½	
No		None	None			Twist sleeves			Copperweld steel		⅜	
No									Steel		⅜	
No		None	None			Compression sleeve			Compos. al steel		No. 1/0	
						Compression joint			Steel		½	
No		None	None			Compression joint			Steel		½	
No		None	None			Compression joint			Compos. al. steel		No. 1/0	
						Twist sleeve			Compos. A.C.S.R.		No. 1/0	
						Compression joint			Compos. al. steel		No. 1/0	
No						Twist sleeve			Steel (insul.)		½	
						Compression joint			Compos. al steel		No. 1/0	
						Compression joint			Steel		⅜	
						Compression joint			Steel		½	
Yes	6, 8		Yes	24x30	24x40	Compression joint			Compos. al steel		No. 2/0	
No						Twist sleeve			Steel		⅜	
No		None	None			Twist sleeve			Steel		⅜	
									Steel (insul.)		½	
No		None	None		Locke No. 8,476	Cu. sleeves	4; oxide film	G. E.				
		Brass clamp, Locke No. 8,476	None		Suspension Locke No. 8,476	Sleeves	3; oxide film	G. E.	S.-M. high strength guy		5/16	
No		None	None		Suspension, No. 4/0		Oxide film	G. E.	None		None	
No		None	None		Suspension, No. 2/0	Twist sleeves	Oxide film	G. E.	None			
No		None	None		Suspension, No. 266,800	Compression sleeves	Auto-valve	Whse	None		None	
No		None	None		Suspension, No. 1/0	Sleeves	Auto-valve	Whse	None		None	
No		None	None		Suspension No. 266,800	Compression sleeves	Oxide film	G. E.	None			
		None	None		Suspension No. 266,800	Compression sleeves	Oxide film	G. E.	None			
No		None	None		Suspension	Twist sleeves	Station	Whse	None		None	
No		None	None		Tie	Twist sleeves	Oxide film	G. E.	None		None	
No		None	None		Suspension, No. 4/0	Twist sleeves	Oxide film	G. E.	None		None	
No		None	None			2-sleeves	Hugo, oxide film	G. E.	None			
No		None	None			2-sleeves	Auto-valve	Whse	None			
No		None	None			Compression joints	Auto-valve	Whse	None			
No		None	None			Compression joints	Auto-valve	Whse	None			
No		None	None			Compression joints	Weleetka, auto-valve	Whse	None			
No		None	None			Compression joints	Oxide film	G. E.	None			
No		None	None			2-sleeves	Auto-valve	Whse	A.C.S.R. (3 mi.)		⅜	
No		None	None			2-sleeves	Tulsa, auto-valve	Whse	A.C.S.R. (3 mi.)		⅜	
No		None	None			2-sleeves	Both ends, auto-valve	Whse				
		None	None			Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.				
		Lower No. 3 E-140	None		Jeffery-Dewitt	Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.				
		None	None		Locke No. 4,333	Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.				
		Lower J.-D.	None		Jeffery-Dewitt	Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.				
		Lower J.-D.	None		Jeffery-Dewitt	Twist sleeves	Sub., l. v. and oxide film	W'hse; G.W				
		O. B. lower	None		Ohio Brass No. 11,551	Twist sleeves	Sub., l. v. and oxide film	W'hse; G.E.				
		Locke No. 8,700, top & bottom	None		Locke No. 8,466	Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.				
		None	None		Locke No. 4,033	Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.				
		Locke No. 12,355—G-8 bottom	None		Locke No. 5,282—G-1	Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.				
		Locke No. 8,700, top and bottom	None		Locke No. 8,466	Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.				
		Locke No. 5,029 top, 12,355 lower	None		Locke No. 8,462	Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.				
		O. B. lower	None		Ohio Brass No. 11,551	Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.				
		O. B. lower	None		Ohio Brass No. 11,551	Twist sleeves	Sub., electrolytic and oxide film	W'hse; G.E.				
		None	None		Ohio Brass	Twist sleeves	Sub., eletrolytic and oxide film	W'hse; G.E.				
		Locke, top and bottom				Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.				
		None	None		Jeffery-Dewitt C. H. 200	Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.				
		O. B. bottom	None		Ohio Brass	Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.				
		None	None		Jeffery-Dewitt	Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.				
		None	None		Locke No. 4,333	Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.				
		None	None		Jeffery-Dewitt, C-100	Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.				
		Lower	None			Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	None			
		Lower	None			Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	None			
		Lower	None			Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.				
		Lower	None		Jeffery-Dewitt	Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.				
		Top J.-D. D. 281; low C.-H. 100	None		Jeffery-Dewitt	Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.				
		Bottom J.-D.; C.-H. 100	None		Jeffery-Dewitt	Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.				
		Lower J.-D.	None		Jeffery-Dewitt No. 70,755	Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.				
		Bottom J.-D.; C.-H. 100	None		Jeffery-Dewitt	Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.				
		Bottom J.-D.; C.-H. 100	None		Jeffery-Dewitt	Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.				
		None	None		Locke No. 5,366—G-1	Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	Siemens-Martin cable		⅜	
		None	None		Jeffery-Dewitt	Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.				
		Lower J.-D.; No. 71,037	None		Jeffery-Dewitt	Twist sleeves	Sub., s. v. and oxide film	W'hse, G.E.				
No		U. L. No. 5,029 G-4; L. 12,355 G-9	None		Locke No. 5,366—G-1	Twist sleeves	Sub., l. v. and oxide film	W'hse; G.E.				
		Lower O. B.	None		Ohio Brass No. 11,551	Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.				
		Lower O. B.	None		Ohio Brass No. 11,551	Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.				
		None	None		Ohio Brass	Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.				
No		None	None		Westinghouse No. 494,485	Double sleeves	Auto-valve and oxide film	W'hse; G.E.				
No		None	None		Westinghouse No. 494,485	Double sleeves	Oxide film	G.E.				
No		None	None		Westinghouse No. 494,485	Double sleeves	Oxide film	G.E.				
No		None	None		Westinghouse No. 494,485	Double sleeves	Oxide film	G.E.				None
No		None	None		Suspension Ohio Brass No. 11,538 No. 2/0	Cu. sleeves	Oxide film	G.E.				5/16
		Furn. with O. B. clamp 70,756	None		Suspension 2-bolt Ohio Brass No. 70,756	Cu. sl. for No. 4/0; str. Cu. Mem. 77	Oxide film	G.E.	Steel cable, high strength, double galvanised			5/16
		Furn. with O. B. clamp 70,756			Suspension Ohio Brass No. 70,756, No. 4/0	Cu. splicing sleeves	Oxide film	G.E.				5/16
No		None			Suspension Ohio Brass No. 11,538, No. 2/0	Cu. sleeves	Oxide film	G.E.				5/16
		Furn. with O. B. clamp 71,037	None		Suspension 2-bolt Ohio Brass No. 71,037	Seamless Aluminum sleeves	Oxide film	G.E.				5/16
		Furn. with O. B. clamp 71,037	None		Suspension 2-bolt Ohio Brass No. 71,037	Seamless Aluminum sleeves	Oxide film	G.E.				5/16
		Furn. with O. B. clamp 71,037	None		Suspension 2-bolt Ohio Brass No. 71,037	Seamless Aluminum sleeves	Oxide film	G.E.	Steel cable, high-strength, double galvanised			5/16
		None	None		Suspension Ohio Brass No. 11,538, No. 2/0	Cu. sleeves	Oxide film	G.E.				5/16
No		None			Suspension Ohio Brass No. 11,538, No. 2	Cu. sleeves	Oxide film	G.E.				5/16
No		None			Suspension Ohio Brass No. 11,538, No. 2	Cu. splicing sleeves	Oxide film	G.E.				5/16
No		None			Suspension Ohio Brass No. 11,538, No. 2	Cu. splicing sleeves	Oxide film	G.E.				5/16
No		None	None		Ohio Brass No. 11,552	Twist sleeves	Oxide film	G.E.	St. c'le, hi-str. d'le galv.			
No						McIntyre joint	Various					
No						McIntyre joint	Various					
Yes	4	Locke grading shields				McIntrye joint	Oxide film	G.E.				
Yes	4	Locke grading shields				McIntyre joint	Oxide film	G.E.				
Yes	4	Locke grading shields				McIntyre joint	Oxide film	G.E.				
No						McIntyre joint	Oxide film	G.E.				
No						McIntyre joint	Oxide film	G.E.				
No						McIntyre joint	Oxide film	G.E.				
No						McIntyre joint	Oxide film	G.E.				
No						McIntyre joint	Oxide film	G.E.				
No						McIntyre joint	Oxide film	G.E.				
No						McIntyre joint	Oxide film	G.E.				
No						McIntyre joint	Oxide film	G.E.				
No						McIntyre joint	Various					
No						McIntyre joint	Oxide film	G.E.				
No						McIntyre joint	Various					
No							Various					
No		Ohio Brass			Ohio Brass No. 70,231, 9¼"	Sleeves	None	None	None			
No		Clamp	None		Suspension Ohio Brass No. 70,756, 9¼'	Sleeves	Oxide film and auto-valve	W'hse; G.E.				
No		Clamp	None		Suspension Ohio Brass No. 70,756, 9¼"	Sleeves	None		None			
No		Clamp	None		Ohio Brass No. 70,756, 9¼"	Sleeves	Oxide film	G.E.	None			
No		Clamp	None		Ohio Brass No. 70,756, 9¼"	Sleeves	Oxide film	G.E.	None			
1 less	5	Lower, main line only, clamp	30		Ohio Brass No. 70,731, 9¼"	Sleeves	Oxide film	G.E.	None			
St. line only	5	Clamp	Yes	30x15	only near station] Ohio Brass							
Yes		Lower only, clamp	None		Suspension Ohio Brass No. 70,756, 9¼"	Sleeves	Oxide film	G.E.	None			
No		Clamp	None		Suspension Ohio Brass No. 70,756, 9¼"	Sleeves	None					
No		Clamp	None		Suspension Ohio Brass No. 70,756, 9¼"	Sleeves	None		None			
No		O. B. suspension clamps			Ohio Brass suspension, No. 4/0	Twist sleeves	Oxide film	G.E.				
No		None	None		Ohio Brass suspension, No. 2/0	Twist sleeves	Oxide film	G.E.	None			
No		None	None		Ohio Brass suspension, No. 2/0	Twist sleeves	Oxide film	G.E.	None			
No		None	None		Ohio Brass suspension, No. 2/0	Twist sleeves	Oxide film	G.E.	None			
No		None	None		Ohio Brass suspension, No. 4/0	Twist sleeves	Oxide film	G.E.	None			
No		None	None		Ohio Brass suspension, No. 4/0	Twist sleeves	Oxide film	G.E.	None			
No		None	None		Ohio Brass suspension, No. 4/0	Twist sleeves	Oxide film	G.E.	None			
No		None	None		Ohio Brass suspension, No. 2/0	Twist sleeves	Oxide film	G.E.	None			
No		None	None		Ohio Brass suspension	Twist sleeves	Yes		None			
No		None	None		Ohio Brass suspension, No. 2/0	Twist sleeves	Oxide film	G.E.	None			
					Tie wire	Twist sleeves	Oxide film	G.E.				

Pin	Locke No. 1,070				No		None	None						Cu. sl
Suspension	Locke No. 5,800	8	Suspension	Locke No. 5,800	No		None	None				Locke No. 8,462		Cu. sl
Pin	Locke No. 1,070				No		None	None						Cu. sl
Brass No. 26,852	Ohio Brass				No									Aluminu
No. 5,960	Lapp	6	No. 5,960	Lapp	No		None	None				Ohio Brass suspension No. 70,755, strain No. 72,703		McIntyre
No. 25,622	Ohio Brass	6	No. 25,622	Ohio Brass								Ohio Brass suspension No. 70,755, strain No. 72,703		McIntyre
No. 5,960	Lapp	6	No. 5,960	Lapp	No		None	None				Ohio Brass suspension No. 70,755, strain No. 72,703		No. 3/0 McIn
No. 5,960	Lapp	6	No. 5,960	Lapp	No							Ohio Brass suspension No. 70,730, strain No. 71,091		Compress
No. 25,622	Ohio Brass	6	No. 26,240	Ohio Brass	No		None	None				Ohio Brass suspension No. 70,730, strain No. 71,091		Compress
No. 25,622	Ohio Brass	6	No. 25,622	Ohio Brass								Ohio Brass suspension No. 70,755, strain No. 72,703		McIntyre
No. 25,622	Ohio Brass	5	No. 25,622	Ohio Brass	No		None	None				Ohio Brass suspension No. 70,755, strain No. 72,703		McIntyre
		6	Suspension No. 2,300	Lapp	No		None					Clevice, No. 2—1/0		Graduate
2,094 vacuum	Lapp	2x11	No. 2,094 vacuum	Lapp	No		None	None				Crosby, 1.19"		Serve splices and
Bell	Locke													
No. 10,566	Ohio Brass	5	No. 10,566	Ohio Brass	No		Bottom only; O. B. 15"	None				Ohio Brass No. 11,548		McIntyre
10" No. 10,566	Ohio Brass	5	10" No. 10,566	Ohio Brass	No		Bottom only; O. B. 15"	None				Ohio Brass No. 11,548		McIntyre
10" No. 25,622	Ohio Brass	9	10" No. 25,622	Ohio Brass	No		Bottom only; O. B. 15"	None				Ohio Brass Nos. 70,731, 11,542		McIntyre
10" No. 10,756	Ohio Brass	6	10" No. 10,756	Ohio Brass	No		Bottom only; O. B. 15"	None				Ohio Brass Nos. 10,879, 10,755		McIntyre
10" No. 25,622	Ohio Brass	9	10" No. 25,620	Ohio Brass	No		Bottom only; 15"	None				Ohio Brass Nos. 70,731, 11,542		McIntyre
10" No. 25,622	Ohio Brass	9	10" No. 25,622	Ohio Brass	No		Bottom only; O. B. 15"	None				Ohio Brass Nos. 10,879, 10,755		McIntyre
10" No. 10,566	Ohio Brass	6	10" No. 10,566	Ohio Brass	No		None	None				Ohio Brass Nos. 10,879, 10,755		McIntyre
10" No. 10,566	Ohio Brass	6	10" No. 10,566	Ohio Brass	No		None	None				Ohio Brass Nos. 10,879, 10,755		McIntyre
10" No. 25,622	Ohio Brass	9	10" No. 25,622	Ohio Brass	No		Bottom only; O. B. 15"	None				Ohio Brass Nos. 10,879, 10,755		McIntyre
10" No. 25,622	Ohio Brass	9	10" No. 25,622	Ohio Brass	No		Bottom only; O. B. 15"	None				Ohio Brass Nos. 70,731, 71,091		McIntyre
10" No. 25,622	Ohio Brass	9	10"	Ohio Brass	No		Bottom only; O. B. 15"	None				Ohio Brass Nos. 11,551, 11,949		McIntyre
66 kv. Pin	Ohio Brass	2	Pin	Ohio Brass	No		None	None				None		
10" No. 25,622	Ohio Brass	6	10" No. 25,622	Ohio Brass	No		Bottom only; O. B. 15"	None				Ohio Brass Nos. 11,551, 70,722		McIntyre
10" No. 25,622	Ohio Brass	9	10" No. 25,622	Ohio Brass	No		Bottom only; O. B. 15"	None				Ohio Brass Nos. 70,731, 11,542		McIntyre
10" No. 25,622	Ohio Brass	6 & 9	10" No. 25,622	Ohio Brass	No		Bottom only; O. B. 15"	None				Ohio Brass Nos. 10,879, 10,755		McIntyre
10" No. 10,566	Ohio Brass	8	10" No. 10,566	Ohio Brass	No		Bottom only; O. B. 15"	None				Ohio Brass No. 11,548		McIntyre
No. 10,566	Ohio Brass	5	No. 10,566	Ohio Brass	No		Bottom only; O. B. 15"					Ohio Brass No. 11,548		McIntyre
10" No. 25,622	Ohio Brass	6	10" No. 25,622	Ohio Brass	No		Bottom only; O. B. 15"	None				Ohio Brass Nos. 70,756, 70,722		McIntyre
10" No. 25,622	Ohio Brass	6	10" No. 25,622	Ohio Brass	No		Bottom only; O. B. 15"	None				Ohio Brass Nos. 10,879, 10,755		McIntyre
10" No. 25,622	Ohio Brass	9	10" No. 25,620	Ohio Brass			Bottom only; O. B. 15"	None				Ohio Brass Nos. 70,731, 11,542		McIntyre
Suspension	Ohio Brass	5	Suspension	Ohio Brass	No		None	None				Aluminum, No. 3/0		Aluminu
No. 25,622	Ohio Brass	9	No. 25,622	Ohio Brass	No		None	None						Twist s
No. 25,622	Ohio Brass	8	No. 25,622	Ohio Brass	No									Twist s
	Locke; O. B.	8		Locke; O. B.	No		None	None						Twist s
Hewlett	Thomas	8	Cap and pin	Ohio Brass			Bottom special							Compres
A	Ohio Brass	8	A	Ohio Brass	No									Twist s
Cap and pin	Ohio Brass	8	Cap and pin	Ohio Brass	No									Twist s
and pin; Hewlett	O. B.; Thomas	8	Cap and pin	Ohio Brass	No									Twist s
Cap and pin	Thomas	8	Cap and pin	Thomas										Twist s
	J.-D.; O. B.	7 & 8		J.-D.; O. B.	No		None	None						Twist s
B. & S.	Ohio Brass	8		Ohio Brass	No		None	None						Twist s
Cap and pin	O. B.; J.-D.	12	Cap and pin	O. B.; J.-D.										Twist s
and pin; Hewlett	O. B.; Thomas	12	Cap and pin; Hewlett	O. B.; Thomas	Yes	8		Yes	24x30	24x40				Compres
No. 25,620	Ohio Brass	12	No. 25,620	Ohio Brass	No		None	None						Twist s
B. & S.	Ohio Brass	8	B. & S.	Ohio Brass	No		None	None						Slee
No. 5,800	Locke	8	No. 5,800	Locke	No		None	None						Twist s
No. 25,620	Ohio Brass	9	No. 25,620	Ohio Brass	No		None	None						Twist s
No. 5,800	Locke	8	No. 5,800	Locke	No									
No. 5,800	Locke	9	No. 5,800	Locke	No									Compres
Cap and pin	O. B.; Loc.; Lapp	9	Cap and pin	O. B.; Locke; W 'e	No		None	None						Compres
Hewlett	Thomas	8	Cap and pin	Ohio Brass										Compres
No. 5,800	Locke	9	No. 5,800	Locke	No		None	None						Compres
No. 5,800	Locke	9	No. 5,800	Locke	No		None	None						Twist s
No. 5,800	Locke	12	No. 5,800	Locke										Compres
Cap and pin	Locke	8	Cap and pin	Locke										Twist s
No. 5,800	Locke	12	No. 5,800	Locke	No									Compres
Cap and pin	Locke	8	Cap and pin	Locke										Compres
No. 5,800	Locke	8	No. 5,800	Locke										Compres
29,500; A-257	J.-D.; O. B.	11 and 12	No. 29,500 A-257	J.-D.; O. B.	Yes	6, 8		Yes	24x30	24x40				Compres
Cap and pin	Ohio Brass	8	Cap and pin	Ohio Brass										Twist s
D.; Hewlett	J.-D.; Thomas	8 and 9	J.-D.; Hewlett	J.-D.; Thomas	No									Twist s
Cap and pin	O. B.; Locke	9	Cap and pin	O. B.; Locke	No		None	None						Twist s
orcel. sock. No. 8,400	Locke	6	[Susp. porcel. sock. No. 8,400	Locke	No		None	None				Locke No. 8,476		Cu. sl
on socket. No. 8,400	Locke	6	Susp. sock. No. 8,400	Locke			Susp. clamp, Locke No. 8,476	None				Suspension Locke No. 8,476		Slee
suspension disc	Ohio Brass	6	10" suspension disc	Ohio Brass	No		None	None				Suspension, No. 4/0		
suspension disc	Westinghouse	6	10" suspension disc	Westinghouse	No		None	None				Suspension, No. 2/0		Twist
suspension disc	Westinghouse	6	10" suspension disc	Westinghouse	No		None	None				Suspension, No. 266,800		Compressi
suspension disc	Westinghouse	6	10" suspension disc	Westinghouse	No		None	None				Suspension, No. 1/0		Slee
pension disc socket	Ohio Brass	6	10" suspension disc socket	Ohio Brass	No		None	None				Suspension No. 266,800		Compressi
10" disc	Ohio Brass						None	None				Suspension No. 266,800		Compressi
suspension disc	Westinghouse	6	10" suspension disc	Westinghouse	No		None	None				Suspension		Twist
O. B. No. 122,552	Ohio Brass	6	10" suspension disc	Ohio Brass	No		None	None				Tie		Twist
suspension disc	Ohio Brass	6	10" suspension disc	Ohio Brass	No		None	None				Suspension, No. 4/0		Twist
disc, cap and pin	Lapp; O. B.	6	10" disc cap and pin	Lapp; O. B.	No		None	None						2-sle
disc, cap and pin	Lapp	6	10" disc cap and pin	Lapp	No		None	None						2-sle
disc, cap and pin	Lapp	6	10" disc cap and pin	Lapp	No		None	None						Compres
disc, cap and pin	Ohio Brass	6	10" disc cap and pin	Ohio Brass	No		None	None						Compres
disc, cap and pin	Ohio Brass	6	10" disc cap and pin	Ohio Brass	No		None	None						Compres
disc, cap and pin	Lapp, Locke	6	10" disc cap and pin	Lapp; Locke	No		None	None						Compres
disc, cap and pin	Ohio Brass	6	10" disc cap and pin	Ohio Brass	No		None	None						2-sle
disc, cap and pin	Locke	6	10" disc cap and pin	Locke	No		None	None						2-sle
10" disc	Lapp	6	10" disc	Lapp	No		None	None						2-sle
Pin No. 12,552	Ohio Brass	1	Pin No. 12,552	Ohio Brass			None	None						Twist
No. A-257	Jeffery-Dewitt	5	No. A-257	Jeffery-Dewitt			Lower No. 3 E-140	None				Jeffery-Dewitt		Twist
No. 25,622	Ohio Brass	5	No. 25,622	Ohio Brass			None	None				Locke No. 4,333		Twist
No. A-257	Jeffery-Dewitt	5	No. A-257	Jeffery-Dewitt			Lower J.-D.	None				Jeffery-Dewitt		Twist
No. A-257	Jeffery-Dewitt	5	No. A-257	Jeffery-Dewitt			Lower J.-D.	None				Jeffery-Dewitt		Twist
No. 25,622	Ohio Brass	5	No. 25,622	Ohio Brass			O. B. lower	None				Ohio Brass No. 11,551		Twist
No. 9,004	Locke, Hewlett	5	No. 9,004	Locke, Hewlett			Locke No. 8,700, top & bottom	None				Locke No. 8,466		Twist
No. 25,622	Ohio Brass	5	No. 25,622	Ohio Brass			None	None				Locke No. 4,033		Twist
No. 25,622	Ohio Brass	5	No. 25,622	Ohio Brass			Locke No. 12,355—G-8 bottom	None				Locke No. 5,282—G-1		Twist
No. 9,004	Locke, Hewlett	5	No. 9,004	Locke; Hewlett			Locke No. 8,700, top and bottom	None				Locke No. 8,466		Twist
No. 5,800	Locke	6	No. 5,800	Locke			Locke No. 5,029 top, 12,355 lower	None				Locke No. 8,462		Twist
No. 25,622	Ohio Brass	5	No. 25,622	Ohio Brass			O. B. lower	None				Ohio Brass No. 11,551		Twist
No. 25,622	Ohio Brass	5	No. 25,622	Ohio Brass			O. B. lower	None				Ohio Brass No. 11,551		Twist
No. 25,622	Ohio Brass	5	No. 25,622	Ohio Brass			None	None				Ohio Brass		Twist
No. 5,800	Locke	6	No. 5,800	Locke			Locke, top and bottom							Twist
No. A-257	Jeffery-Dewitt	4		Jeffery-Dewitt			None	None				Jeffery-Dewitt C. H. 200		Twist
No. 25,622	Ohio Brass	5	No. 25,622	Ohio Brass			O. B. bottom	None				Ohio Brass		Twist
No. A-257	Jeffery-Dewitt	4	No. A-257	Jeffery-Dewitt			None	None				Jeffery-Dewitt		Twist
No. 25,622	Ohio Brass	5	No. 25,622	Ohio Brass			None	None				Locke No. 4,333		Twist
No. A-257	Jeffery-Dewitt	5	No. A-257	Jeffery-Dewitt			None	None				Jeffery-Dewitt, C-100		Twist
No. A-257	Jeffery-Dewitt	5	No. A-257	Jeffery-Dewitt			Lower	None						Twist
No. A-257	Jeffery-Dewitt	5	No. A-257	Jeffery-Dewitt			Lower	None						Twist
No. A-257	Jeffery-Dewitt	5	No. A-257	Jeffery-Dewitt			Lower	None				Jeffery-Dewitt		Twist
No. A-257	Jeffery-Dewitt	6	No. A-257	Jeffery-Dewitt			Top J.-D. D. 281; low C.-H. 100	None				Jeffery-Dewitt		Twist
No. A-257	Jeffery-Dewitt	5	No. A-257	Jeffery-Dewitt			Bottom J.-D.; C.-H. 100	None				Jeffery-Dewitt		Twist
No. A-257	Jeffery-Dewitt	6	No. A-257	Jeffery-Dewitt			Lower J.-D.	None				Jeffery-Dewitt No. 70,755		Twist
No. A-257	Jeffery-Dewitt	5	No. A-257	Jeffery-Dewitt			Bottom J.-D.; C.-H. 100	None				Jeffery-Dewitt		Twist
No. A-257	Jeffery-Dewitt	5	No. A-257	Jeffery-Dewitt			Bottom J.-D.; C.-H. 100	None				Jeffery-Dewitt		Twist
No. 5,800	Locke	5	No. 5,800	Locke			None	None				Locke No. 5,366—G-1		Twist
No. A-257	Jeffery-Dewitt	5	No. A-257	Jeffery-Dewitt			None	None				Jeffery-Dewitt		Twist
No. A-257	Jeffery-Dewitt	5	No. A-257	Jeffery-Dewitt			Lower J.-D.; No. 71,037	None				Jeffery-Dewitt		Twist
No. 5,800	Locke	7	No. 5,800	Locke	No		U. L. No. 5,029 G-4; L. 12,355 G-9	None				Locke No. 5,366—G-1		Twist
No. 25,622	Ohio Brass	5	No. 25,622	Ohio Brass			Lower O. B.	None				Ohio Brass No. 11,551		Twist
No. 25,622	Ohio Brass	5	No. 25,622	Ohio Brass			Lower O. B.	None				Ohio Brass No. 11,551		Twist
No. 25,622	Ohio Brass	5	No. 25,622	Ohio Brass			None	None				Ohio Brass		Twist
Suspension	Westinghouse	6	Suspension	Westinghouse	No		None	None				Westinghouse No. 494,485		Double
Suspension	Westinghouse	5	Suspension	Westinghouse	No		None	None				Westinghouse No. 494,485		Double
Suspension	Westinghouse	6	Suspension	Westinghouse	No		None	None				Westinghouse Nol 494,485		Double
Suspension	Westinghouse	6	Suspension	Westinghouse	No		None	None				Westinghouse No. 494,485		Double
pension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	No		None	None				Suspension Ohio Brass No. 11,538 No. 2/0		Cu. sl
pension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass			Furn. with O. B. clamp 70,756	None				Suspension 2-bolt Ohio Brass No. 70,756		Cu. sl. for No. 4/0
pension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass			Furn. with O. B. clamp 70,756					Suspension Ohio Brass No. 70,756, No. 4/0		Cu. splici
pension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	No		None					Suspension Ohio Brass No. 11,538, No. 2/0		Cu. sl
pension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass			Furn. with O. B. clamp 71,037	None				Suspension 2-bolt Ohio Brass No. 71,037		Seamless Alum
pension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass			Furn. with O. B. clamp 71,037	None				Suspension 2-bolt Ohio Brass No. 71,037		Seamless Alum
pension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass			Furn. with O. B. clamp 71,037	None				Suspension 2-bolt Ohio Brass No. 71,037		Seamless Alum
pension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass			None	None				Suspension Ohio Brass No. 11,538, No. 2/0		Cu. sl
pension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	No		None					Suspension Ohio Brass No. 11,538, No. 2		Cu. sl
pension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	No		None					Suspension Ohio Brass No. 11,538, No. 2		Cu. splici
pension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	No		None					Suspension Ohio Brass No. 11,538, No. 2		Cu. splici
pension No. 26,731	Ohio Brass	5	Suspension	Ohio Brass	No		None	None				Ohio Brass No. 11,552		Twist
suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	No									McInty
suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	No									McInty
suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	Yes	4	Locke grading shields							McIntry
suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	Yes	4	Locke grading shields							McInty
" suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	Yes	4	Locke grading shields							McInty
suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	No									McInty
suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	No									McInty
suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	No									McInty
Pin 66 Kv.	Graybar	6	Suspension disc 10"	Ohio Brass	No									McInty
suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	No									McInty
suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	No									McInty
Pin	Graybar Elec.	6	Suspension disc 10"	Ohio Brass	No									McInty
suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	No									McInty
suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	No									McInty
suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	No									McInty
Pin	Graybar	6	Suspension disc 10"	Ohio Brass	No									
o. 11,069; No. A-257	Thomas, J-D.	6	Suspension	Thomas; J.-D.	No		Ohio Brass					Ohio Brass No. 70,231, 9¼"		Slee
pension cap and ball	Ohio Brass	6	Suspension cap and ball	Ohio Brass	No		Clamp	None				Suspension Ohio Brass No. 70,756, 9¼'		Slee
pension No. 25,622	Ohio Brass	6	Suspension cap and ball	Ohio Brass	No		Clamp	None				Suspension Ohio Brass No. 70,756, 9¼"		Slee
pension cap and ball	Ohio Brass	6	Suspension cap and ball	Ohio Brass	No		Clamp	None				Ohio Brass No. 70,756, 9¼"		Slee
pension cap and ball	Ohio Brass	6	Suspension cap and ball	Ohio Brass	No		Clamp	None				Ohio Brass No. 70,756, 9¼"		Slee
pension No. 25,622	Ohio Brass	2x10	Suspension No. 25,622	Ohio Brass	1 less	5	Lower, main line only, clamp	30				Ohio Brass No. 70,731, 9¼"		Slee
pension No. 25,622	Ohio Brass	10	Suspension No. 25,522	Ohio Brass	St. line only	5	Clamp	Yes	30x15	only near station]		Ohio Brass		
pension No. 25,622	Ohio Brass	6	Suspension cap and ball	Ohio Brass	Yes		Lower only, clamp	None				Suspension Ohio Brass No. 70,756, 9¼"		Slee
pension No. 25,622	Ohio Brass	6	Suspension cap and ball	Ohio Brass	No		Clamp	None				Suspension Ohio Brass No. 70,756, 9¼"		Slee
pension No. 25,622	Ohio Brass	6	Suspension cap and ball	Ohio Brass	No		Clamp	None				Suspension Ohio Brass No. 70,756, 9¼"		Slee
pension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	No		O. B. suspension clamps					Ohio Brass suspension, No. 4/0		Twist
pension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	No		None	None				Ohio Brass suspension, No. 2/0		Twist
Pin No. 12,552	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	No		None	None				Ohio Brass suspension, No. 2/0		Twist
pension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	No		None	None				Ohio Brass suspension, No. 2/0		Twist
pension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio Brass	No		None	None				Ohio Brass suspension, No. 4/0		Twist
pension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio Brass	No		None	None				Ohio Brass suspension, No. 4/0		Twist
pension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio Brass	No		None	None				Ohio Brass suspension, No. 4/0		Twist
pension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	No		None	None				Ohio Brass suspension, No. 2/0		Twist
pension No. 35,622		6	Suspension		No		None	None				Ohio Brass suspension		Twist
pension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio Brass	No		None	None				Ohio Brass suspension, No. 2/0		Twist

Cu. sleeves	Auto-valve	W'hse	Siemens-Martin steel	3/8	1	No. 2 solid copper	Metallic circ. No. 6 solid cu.	49
Cu. sleeves	2 auto-valve; 2 oxide film	W'hse; G.E.	Siemens-Martin steel	3/8	1	No. 2 solid copper	Metallic circ. No. 6 copperweld	50
Cu. sleeves	Auto-valve	W'hse	Siemens-Martin steel	3/8	1	No. 2 solid copper	Metallic circ. No. 6 solid copperweld	51
uminum sleeves	Oxide film	G. E.	None	.....	1	No. 6 galvanized iron	Metallic circ. No. 6 copperweld	52
cIntyre sleeves	At end, oxide film	G. E.	None	.....	.....	Towers have earth anchors	Telephone on 33 kv.	1
cIntyre sleeves	Oxide film	G. E.	None	.....	.....	.....	Carrier current	2
0 McIntyre sleeves	Oxide film	G. E.	None	.....	.....	None	None	3
mpressor joint	Oxide film	G. E.	None	.....	.....	.....	None	4
mpressor joints	Oxide film	G. E.	.....	.....	.....	.....	Carrier current	5
cIntyre sleeves	Oxide film	G. E.	.....	.....	.....	.....	None	6
cIntyre sleeves	Oxide film	G. E.	None	.....	.....	.....	Carrier current	7
nduated sleeve	At sta., oxide film	G. E.	Siemens-Martin galv.	5/16	1	20'1¼" driver pipe	50 pair cable	8
es and Crosby clamps	Auto-valve	W'hse	Copperweld	3/8	2	Driven pipes	None	9
.....	.....	.....	None	.....	.....	.....	.....	10
cIntyre sleeves	.....	.....	Cu.	No. 1/0	.....	.....	.....	11
cIntyre sleeves	.....	.....	Cu.	No. 1/0	.....	.....	.....	12
cIntyre sleeves	.....	.....	S.-M. galv. steel	3/8	.....	Steel towers only	.....	13
cIntyre sleeves	.....	.....	Cu. clad	No. 1	.....	.....	.....	14
cIntyre sleeves	.....	.....	None	.....	.....	.....	.....	15
cIntyre sleeves	.....	.....	None	.....	.....	Steel towers only	.....	16
cIntyre sleeves	.....	.....	S.-M. h. s. galv. steel	¼	.....	.....	.....	17
cIntyre sleeves	.....	.....	S.-M. h. s. galv. steel	¼	.....	.....	.....	18
cIntyre sleeves	.....	.....	S.-M. galv. steel	3/8	.....	Steel towers only	.....	19
cIntyre sleeves	.....	.....	S.-M. galv. steel	3/8	1	Steel towers only	.....	20
cIntyre sleeves	.....	.....	S.-M. galv. steel	3/8	.....	Steel towers only	.....	21
cIntyre sleeves	.....	.....	None	.....	.....	.....	.....	22
cIntyre sleeves	.....	.....	None	.....	.....	.....	.....	23
cIntyre sleeves	.....	.....	S.-M. h. s. galv. steel	3/8	.....	Steel towers only	.....	24
cIntyre sleeves	.....	.....	S.-M. galv. steel	5/16	.....	Steel towers only	.....	25
cIntyre sleeves	.....	.....	S.-M. galv. steel	3/8	.....	Steel towers only	.....	26
cIntyre sleeves	.....	.....	S.-M. galv. steel	3/8	2	.....	.....	27
cIntyre sleeves	.....	.....	S.-M. h. s. galv. steel	3/8	.....	Steel towers only	.....	28
cIntyre sleeves	.....	.....	S.-M. galv. steel	.....	.....	.....	.....	29
cIntyre sleeves	.....	.....	S.-M. galv. steel	3/8	1	Steel towers only	.....	30
uminum sleeves	None	.....	None	.....	.....	None	Public telephone	31
Twist sleeve	.....	.....	Steel	3/8	2	No. 4 copper	Private telephone	32
Twist sleeve	.....	.....	Steel	3/8	1	None	None	33
mpression joint	.....	.....	Steel	3/8	2	None	Private telephone	34
Twist sleeve	.....	.....	Steel	½	2	No. 4 copper	Private telephone	35
Twist sleeve	.....	.....	Steel	3/8	2	.....	Private telephone	36
Twist sleeve	.....	.....	Steel	½	1	.....	Private telephone	37
Twist sleeve	.....	.....	Steel	3/8	2	.....	Private telephone	38
Twist sleeve	.....	.....	Steel	3/8	1	.....	Private telephone	39
Twist sleeve	.....	.....	Steel	3/8	2	No. 4 Cu. on each pole	Private telephone	40
Twist sleeve	.....	.....	Steel	3/8	2	No. 4 copper	Private telephone	41
mpression joint	.....	.....	Steel	½	2	No. 4 copper	None	42
Twist sleeve	.....	.....	Compos. al. steel	No. 2/0	2	.....	.....	43
Sleeves	.....	.....	Steel	3/8	2	No. 4 copper	Private telephone	44
Twist sleeves	.....	.....	Steel	3/8	2	No. 4 copper	Private telephone	45
Twist sleeves	.....	.....	Steel	½	2	None	Private telephone	46
.....	.....	.....	Copperweld steel	3/8	2	None	None	47
.....	.....	.....	Steel	3/8	2	No. 4 copper	Private telephone	48
mpression sleeve	.....	.....	Compos. al steel	No. 1/0	2	No. 4 copper	Private telephone	49
mpression joint	.....	.....	Steel	½	2	No. 4 copper	Carrier current	50
mpression joint	.....	.....	Steel	½	2	No. 4 copper	Private telephone	51
mpression joint	.....	.....	Compos. al. steel	No. 1/0	2	No. 4 copper	Carrier current	52
Twist sleeve	.....	.....	Compos. A.C.S.R.	No. 1/0	2	No. 4 copper	Carrier current	53
mpression joint	.....	.....	Compos. al. steel	No. 1/0	2	No. 4 copper	Insulated ground wire	54
Twist sleeve	.....	.....	Steel (insul.)	½	2	No. 4 copper	.....	55
mpression joint	.....	.....	Compos. al steel	No. 1/0	2	No. 4 copper	.....	56
mpression joint	.....	.....	Steel	3/8	2	No. 4 copper	Private telephone	57
mpression joint	.....	.....	Steel	½	2	.....	.....	58
Twist sleeve	.....	.....	Compos. al steel	No. 2/0	2	.....	None	59
Twist sleeve	.....	.....	Steel	3/8	2	No. 4 copper	Private telephone	60
Twist sleeve	.....	.....	Steel	3/8	2	No. 4 copper	Carrier current	61
Twist sleeve	.....	.....	Steel (insul.)	½	2	No. 4 copper	Carrier current	62
.....	.....	.....	.....	.....	.....	.....	.....	63
.....	.....	.....	.....	.....	.....	.....	.....	64
Cu. sleeves	4; oxide film	G. E.	S.-M. high strength guy	5/16	1	No. 3 bare stranded cu. wire fastened to bottom of pole	None	1
Sleeves	3; oxide film	G. E.	S.-M. high strength guy	5/16	1		None	2
.....	Oxide film	G. E.	None	None	.....	No. 4 iron	Metallic circuit	3
Twist sleeves	Oxide film	G. E.	None	.....	.....	No. 4 iron	Metallic circuit	4
npression sleeves	Auto-valve	W'hse	None	None	.....	No. 4 iron	Metallic circuit	5
Sleeves	Auto-valve	W'hse	None	None	.....	No. 4 iron	Metallic circuit	6
npression sleeves	Oxide film	G. E.	None	.....	.....	No. 4 iron	Metallic circuit	7
npression sleeves	Oxide film	G. E.	None	.....	.....	No. 4 iron	Metallic circuit	8
Twist sleeves	Station	W'hse	None	None	.....	No. 4 iron	Metallic circuit	9
Twist sleeves	Oxide film	G. E.	None	None	.....	None	Metallic circuit	10
Twist sleeves	Oxide film	G. E.	None	None	.....	No. 4 iron	Metallic circuit	11
2-sleeves	Hugo, oxide film	G. E.	None	.....	.....	Wire down pole only	Private circuit on W. U. poles	12
2-sleeves	Auto-valve	W'hse	None	.....	.....	Wire down pole	Leased Bell circuit	13
mpression joints	Auto-valve	W'hse	None	.....	.....	Wire down pole	Leased Bell circuit	14
mpression joints	Auto-valve	W'hse	None	.....	.....	Wire down pole	None	15
mpression joints	Weleetka, auto-valve	W'hse	None	.....	.....	No. 6 galvanized iron on pole only	Leased Bell circuit	16
mpression joints	Oxide film	G. E.	None	.....	.....	Wire down pole	Leased Bell circuit	17
2-sleeves	Auto-valve	W'hse	A.C.S.R. (3 mi.)	¾	1	Wire down pole	Leased Bell and private circuit	18
2-sleeves	Tulsa, auto-valve	W'hse	A.C.S.R. (3 mi.)	¾	2	Wire down pole	None	19
2-sleeves	Both ends, auto-valve	W'hse	.....	.....	.....	.....	None	20
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	Bell	21
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	Southwestern Bell	22
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	High line telephone	23
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	Leased Southwest Bell	24
Twist sleeves	Sub., l. v. and oxide film	W'hse; G.W	.....	.....	None	No. 4 B. B.—galvanized iron	Southwest Bell and carrier	25
Twist sleeves	Sub., l. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	Southwest Bell telephone	26
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	Southwest Bell telephone	27
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	Southwest Bell telephone	28
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	.....	29
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	Southwest Bell telephone	30
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	High line telephone and carrier	31
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	Leased Southwest Bell telephone	32
Twist sleeves	Sub., electrolytic and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	Leased Southwest Bell telephone	33
Twist sleeves	Sub., eletrolytic and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	High line telephone	34
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	High line telephone	35
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	Oklahoma Gas & Electric telephone line	36
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	Southwest Bell telephone	37
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	Oklahoma Gas & Electric telephone line	38
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	Oklahoma Gas & Electric telephone line	39
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	None	.....	.....	No. 4 B. B.—galvanized iron	Southwest Bell telephone	40
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	None	.....	.....	No. 4 B. B.—galvanized iron	Leased Southwest Bell	41
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	Leased Southwest Bell	42
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 3 B. B.—galvanized iron	Leased Southwest Bell	43
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	High line telephone Oklahoma Gas & Electric	44
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 3 B. B.—galvanized iron	Leased Southwest Bell	45
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	Leased wire, Bell	46
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	Leased Southwest Bell	47
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	Leased Southwest Bell	48
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	Siemens-Martin cable	3/8	1	No. 4 B. B.—galvanized iron	Leased Southwest Bell	49
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	Southwest Bell telephone	50
Twist sleeves	Sub., s. v. and oxide film	W'hse, G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	Southwest Bell telephone	51
Twist sleeves	Sub., l. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	Southwest Bell telephone	52
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	Southwest Bell telephone	53
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	Southwest Bell telephone	54
Twist sleeves	Sub., s. v. and oxide film	W'hse; G.E.	.....	.....	None	No. 4 B. B.—galvanized iron	Oklahoma Gas & Electric telephone	55
Double sleeves	Auto-valve and oxide film	W'hse; G.E.	.....	.....	None	No. 6 copperweld	Leased Southwest Bell	56
Double sleeves	Oxide film	G. E.	.....	.....	None	No. 4 B. B.—gold iron	Leased Southwest Bell	57
Double sleeves	Oxide film	G. E.	.....	.....	None	No. 6 copperweld	Leased Southwest bell	58
Double sleeves	Oxide film	G. E.	.....	None	None	No. 6 copperweld	Leased Southwest Bell	59
Cu. sleeves	Oxide film	G. E.	Steel cable, high strength, double galvanized	7/16	1	No. 2 solid S.-D. Cu. and ground pipe	Independent telephone	60
No. 4/0; str. Cu. Mem. 77	Oxide film	G. E.		7/16	1	No. 2 solid S.-D. Cu. and ground pipe	Independent telephone	61
splicing sleeves	Oxide film	G. E.		7/16	1	No. 2 bare solid S.-D. Cu. and ground pipr	Independent telephone	62
Cu. sleeves	Oxide film	G. E.		7/16	1	No. 2 bare solid S.-D. Cu. and ground pipe	Independent telephone	63
e Aluminum sleeves	Oxide film	G. E.		7/16	1	No. 2 bare solid S.-D. Cu. and ground pipe	None	64
e Aluminum sleeves	Oxide film	G. E.		7/16	1	No. 2 bare solid S.-D. Cu. and ground pipe	None	65
Aluminum sleeves	Oxide film	G. E.	Steel cable, high-strength, double galvanized	7/16	1	No. 2 bare solid S.-D. Cu. and ground pipe	Independent telephone	66
Cu. sleeves	Oxide film	G. E.		7/16	1	No. 2 bare solid S.-D. Cu. and ground pipe	Independent telephone	67
Cu. sleeves	Oxide film	G. E.		7/16	1	No. 2 bare solid S.-D. Cu. and ground pipe	Independent telephone	68
splicing sleeves	Oxide film	G. E.		7/16	1	No. 2 bare solid S.-D. Cu. and ground pipe	Independent telephone	69
splicing sleeves	Oxide film	G. E.		7/16	1	No. 2 bare solid S.-D. Cu. and ground pipe	Independent telephone	70
Twist sleeves	Oxide film	G. E.	St. c'le, hi-str. d'le galv.	.....	.....	None	Carrier current	71
cIntyre joint	Various	.....	.....	.....	.....	No. 6 copperweld	None	72
cIntyre joint	Various	.....	.....	.....	.....	No. 6 copperweld	None	73
cIntyre joint	Oxide film	G. E.	.....	.....	.....	No. 6 copperweld	No. 8 solid Cu.	74
cIntyre joint	Oxide film	G. E.	.....	.....	.....	No. 6 copperweld	No. 5 Copperweld	75
cIntyre joint	Oxide film	G. E.	.....	.....	.....	No. 6 copperweld	No. 5 high tensil Cu.-weld	76
cIntyre joint	Oxide film	G. E.	.....	.....	.....	No. 6 copperweld	No. 8 copper	77
cIntyre joint	Oxide film	G. E.	.....	.....	.....	No. 6 copperweld	No. 8 copper	78
cIntyre joint	Oxide film	G. E.	.....	.....	.....	No. 6 copperweld	No. 5 copperweld	79
cIntyre joint	Oxide film	G. E.	.....	.....	.....	No. 6 copperweld	No. 5 copperweld	80
cIntyre joint	Oxide film	G. E.	.....	.....	.....	No. 6 copperweld	No. 8 copper	81
cIntyre joint	Oxide film	G. E.	.....	.....	.....	No. 6 copperweld	No. 8 copper	82
cIntyre joint	Oxide film	G. E.	.....	.....	.....	No. 6 copperweld	No. 6 A.C.S.R.	83
cIntyre joint	Various	.....	.....	.....	.....	No. 6 copperweld	None	84
cIntyre joint	Oxide film	G. E.	.....	.....	.....	No. 6 copperweld	No. 5 high tension copperweld	85
cIntyre joint	Various	.....	.....	.....	.....	No. 6 copperweld	No. 5 high tension copperweld	86
.....	Various	.....	.....	.....	.....	No. 6 copperweld	No. 5 high tension copperweld	87
Sleeves	None	None	None	.....	.....	No. 6 galvanized iron wire	None	88
Sleeves	Oxide film and auto-valve	W'hse; G.E.	.....	.....	.....	No. 6 galvanized iron wire	Magneto 2-wire	89
Sleeves	None	.....	None	.....	.....	No. 6 galvanized iron wire	None	90
Sleeves	Oxide film	G. E.	None	.....	.....	No. 6 galvanized iron wire	Magneto 2-wire	91
Sleeves	Oxide film	G. E.	None	.....	.....	No. 6 galvanized iron wire	Magneto 2-wire	92
Sleeves	Oxide film	G. E.	None	.....	.....	No. 6 galvanized iron wire	Telephone	93
.....	.....	.....	.....	.....	.....	.....	None	94
Sleeves	Oxide film	G. E.	None	.....	.....	No. 6 galvanized iron	Magneto 2-wire	95
Sleeves	None	.....	.....	.....	.....	No. 6 galvanized iron	Magneto 2-wire	96
Sleeves	None	.....	None	.....	.....	No. 6 galvanized iron	None	97
Twist sleeves	Oxide film	G. E.	.....	.....	.....	No. 6 iron wire	Independent telephone	98
Twist sleeves	Oxide film	G. E.	.....	.....	.....	No. 6 galvanized iron wire	Independent telephone	99
Twist sleeves	Oxide film	G. E.	None	.....	.....	No. 6 copperweld	Telephone circuit on same poles	100
Twist sleeves	Oxide film	G. E.	None	.....	.....	No. 6 copperweld	Telephone on same poles	101
Twist sleeves	Oxide film	G. E.	None	.....	.....	No. 6 iron wire	Telephone on same poles	102
Twist sleeves	Oxide film	G. E.	None	.....	.....	No. 6 iron wire	Telephone on same poles	103
Twist sleeves	Oxide film	G. E.	None	.....	.....	No. 6 galvanized iron wire	Telephone on independent poles	104
Twist sleeves	Oxide film	G. E.	None	.....	.....	No. 6 iron wire	Telephone on same poles	105
Twist sleeves	Oxide film	G. E.	None	.....	.....	No. 6 iron wire	Telephone on same poles	106
Twist sleeves	Yes	.....	None	.....	.....	Copperweld	Telephone on same poles	107
Twist sleeves	Oxide film	G. E.	None	.....	.....	No. 6 iron wire	Telephone on same poles	108
.....	Oxide film	G. E.	None	.....	.....	.....	.....	109

74	Uvalde—Val Verde Co. Line									
75	Sabinal—Uvalde	1927	20,000	66	60	Wood poles	1	23.0		
76	Carrizo Springs—Uvalde	1928	20,000	66	60	Wood poles	1	52.0		
77	Lizzie—Weimer	1926—1927	10,000	66	60	Wood poles	1	42.0		
78	Weimer—Luling	1927	20,000	66	60	Wood poles	1	44.0		
79	Dilley—Asherton	1927	10,000	66	60	Wood poles	1	45.0		
80	Asherton—Carrizo Springs	1926	10,000	66	60	Wood poles	1	8.0		
81	Cuero—Harwood	1926—1927	8,000	66	60	Wood poles	1	41.0		
82	Victoria—Cuero	1923	20,000	66	60	Wood poles	1	28.0		
83	Sinton—Robstown	1924	4,700	66	60	Wood poles	1	23.0		
84	Sinton—Taft	1927	12,000	66	60	Wood poles	1	10.0		
85	Victoria—Beeville—Sinton	1927	20,000	66	60	Wood poles	1	83.0		
86	Edna—Victoria	1926	8,000	66	60	Wood poles	1	29.0		
87	Pierce—Edna	1926	8,000	66	60	Wood poles	1	33.0		
	San Antonio Public Service Co.									
88	McQueeney—Luling	1928	20,000	66	60	Wood poles	1	20.0		
89	New Braunfels—McQueeney	1926	21,000	60	60	Wood poles	1	13.2		
90	New Braunfels—Dittlinger	1927	26,000	60	60	Wood poles	1	1.63		
91	New Braunfels—Spanish Pass	1926	8,000	60	60	Wood poles	1	40.9		
92	New Braunfels—Hunter		15,000	60	60	Wood poles	1	10.10		
93	San Antonio—New Braunfels No. 1	1925	16,000	76	60	Wood poles	1	32.0		
94	San Antonio—New Braunfels No. 2	1927	20,000	76	60	Wood poles	1	28.5		
95	San Antonio—Floresville	1927	10,000	66	60	Wood poles	1	28.5		
96	San Antonio—Sabinal	1926	3,000	66	60	Wood poles	1	67.6		
97	Sabinal Line—Pleasanton Metering Station	1926	2,000	66	60	Wood poles	1	7.2		
	West Texas Utilities Co.									
98	Big Lake—Ozona	1927		66	60	Wood poles	1	38.0		
99	Childress—Shamrock	1928		66	60	Wood poles	1	56.0		
100	Childress—Kirkland	1928		66	60	Wood poles	1	16.0		
101	Kirkland—Quanah	1928		66	60	Wood poles	1	15.0		
102	Quanah—Throckmorton	1927		66	60	Wood poles	1	97.0		
103	Throckmorton—Putman	1927		66	60	Wood poles	1	81.0		
104	Quanah—Chillicothe	1928		66	60	Wood poles	1	16.0		
105	Chillicothe—Vernon	1927		66	60	Wood poles	1	14.0		
106	Vernon—Red River	1928		66	60	Wood poles	1	8.0		
107	Vernon—Electra	1927		66	60	Wood poles	1	24.0		
108	Munday—Baylor County	1928		66	60	Wood poles	1	8.0		
109	Crowell—Metador	1927		66	60	Wood poles	1	64.0		
110	Melvin—Brady	1928		60	60	Wood poles	1	19.0		
111	San Angelo—Barnhart	1927		66	60	Wood poles	1	55.0		
112	Barnhart—McCamey	1927		66	60	Wood poles	1	75.0		
113	McCamey—Crane County Line	1927		66	60	Wood poles	1	16.0		
114	McCamey—Girvin Plant	1928		66	60	Wood poles	1	11.0		
115	McCamey—Val Verde County Line	1928		66	60	Wood poles	1	90.0		
116	Roby—Jayton	1928		66	60	Wood poles	1	38.0		
117	Eskota—Roby	1925		60	60	Wood poles	1	22.0		
118	Lem—Eskota	1927		132	60	Wood poles	1	75.0		
119	Abilene—Eskota	1928		66	60	Wood poles	2	35.0		
120	[illegible]	1926		60	60	Wood poles	1	51.0		
121	Abilene—Ballinger	1926		66	60	Wood poles	1	54.0		
122	Ballinger—Brown County	1925		60	60	Wood poles	1	51.0		
123	Ballinger—San Angelo	1926		60	60	Wood poles	1	38.0		
124	Ballinger—Eden	1925		60	60	Wood poles	1	38.0		
125	Eden—Menard—Mason	1926		60	60	Wood poles	1	22.0		
	El Paso Electric Co.									
126	El Paso—Fabens	1926	3,000	66	60	Wood poles	1	26.0		
	MOUNTAIN									
	Southern Colorado Power Co.									
1	Pueblo—Canon City	1926	7,500	66	60	Wood poles	1	43.0		
2	Pueblo—La Junta	1922	3,000	66	60	Wood poles	1	64.72		
	Public Service Co. of Colorado									
3	Valmont Station—Denver Terminal	1924	50,000	90	60	Steel towers	1 (2 ult.)	23.01	A 7,600; B	
4	Valmont—Boulder Canyon Stations	1924	50,000	90	60	Steel towers	1	8.15	6,000; 12,	
5	Boulder Canyon—Denver Terminal	1909	25,000	90	60	Steel towers	1	29.83	A-3,00	
6	Shoshone Station—Denver Terminal	1909 and 1928	25,000	90	60	S.T. and W.P.	1	151.42	A-6,000; B-	
7	Leadville—Gilman	1929	36,500	90	60		1	30.4		
	Salt River Valley Water Users' Association									
8	Superior—Mesa(2)	1926		110	25	Steel towers	1	97.35	2,80	
9	Goldfield—Superior	1926		110	25	Steel towers	1	28.6	2,80	
10	Superior—Ray	1927		110	25	Steel towers	1	13.0	2,80	
11	Mormon Flats—Mormon Flats Junction	1926		110	25	Steel towers	1	1.25	2,80	
	The Arizona Power Co.									
12	Childs Hydro Plant—Sycamore Sub	1925	10,000	66	60	Steel towers	1	18.4	2,20	
	PACIFIC									
	City of Tacoma Light Division of Public Utilities Department									
1	Tacoma	1926	100,000	110	60	Wood poles	1	44.0		
	City of Seattle, Department of Lighting									
2	Gorge Plant, Skagit River—Seattle	1924	90,000	165	60	Wood poles	1	100.24		
	Eastern Oregon Light & Power Co.									
3	Durkee—Baker	1927	10,000	66	60	Wood towers	1	23.0		
4	Baker—La Grande	1928	7,500	66	60	Wood poles	1	47.0		
	The California Oregon Power Co.									
5	Fall Creek—Weed	1924	7,000	66	60	Wood poles	1	47.1		
6	Fall Creek—Klamath Falls	1912	9,400	66	60	Wood poles	1	43.9		
7	Fall Creek—Klamath Falls	1926	18,000	66	60	Wood poles	1	38.6		
8	Klamath Falls—Chiloquin	1923	7,000	66	60	Wood poles	1	30.3		
9	Fall Creek—Gold Ray	1924	9,000	66	60	Wood poles	1	47.3		
10	Prospect—Gold Ray	1912	11,000	66	60	Wood poles	1	38.0		
11	Prospect—Springfield	1922	8,000	66	60	Wood poles	1	123.0		
12	Prospect—Copco	1927	25,000	66	60	Wood poles	1	67.5		
13	Copco—Delta	1909 and 1917	11,000	66	60	Wood poles	1	79.3		
14	Copco—Delta	1924	40,000	120	60	Wood poles	1	77.5		
	Mountain States Power Co.									
15	Albany—Corvallis	1925	15,000	66	60	Wood poles	1	11.5		
16	Springfield—West Salem	1925	15,000	66	60	Wood poles	1	75.2		
	San Diego Consolidated Gas & Electric Co.									
17	Del Mar—Escondido			66		Wood poles	1	18.0		
18	Escondido—Rincon			88			1	16.79		
19	San Diego—Capistrano			66		Wood poles	1	73.42		
20	San Diego—El Cajon	1927	10,000	66	60	Wood poles	1	10.71		
	Southern Sierras Power Co.									
21	Adams Main Plant—Junction with Rush Creek—Control Station Line	1920		100	60	Wood poles	1	1.61		
22	Bishops Cr. Plant No. 5—Control Station	1909		100	60	Wood poles	1	.20		
23	Bishops Cr. Plant No. 6—Control Station	1913		100	60	Steel poles	1	1.36	1,729 incl. X	
24	Control Station—San Bernardino	1912	50,000	100	60	Steel towers	2	238.16	3,70 0; 4,300; 4,700; R.R.	
25	San Bernardino—Rincon	1927		88	60	Wood poles	1	65.95		
26	San Bernardino—El. Centro via. Coachella	1914	7,500	88	60	Wood poles	1	165.01		
27	El Centro—Rincon	1924		88	60	Wood poles	1	99.54		
28	El Centro—Colorado River Sub	1917		88	60	Wood poles	1	59.95		
29	Near Banning—Forest Home	1925	3,000	88	60	Wood poles	1	7.16		
	Nevada—California Power Co., Owner, Operated by Southern Sierras Power Co.									
30	Pool Plant—Rush Creek Plant	1918—1924		100	60	Wood poles	1	21.57		
31	Rush Creek Plant—Control Station	1918	35,000	100	60	Wood poles	1	54.07		
32	Bishop Cr. Plant No. 5—Control Station	1913		100	60	Steel poles	1	3.72	1,729 incl. X	
33	Bishop Cr. Plant No. 4—Junction with Bishop Cr Plant No. 3 Line	1922		100	60	Wood poles	1	.72		
	Southern California Edison Co.									
34				66	60	Wood poles	1	10.0		
35				66	60	Wood poles	1	10.0		
36				66	60	Wood poles	1	60.0		
37				66	60	Wood poles	1	63.2		
38				66	60	Wood poles	1	76.5		
39				66	50	Wood poles	1	27.6		
40				66	50	Wood poles	1	36.0		
41				66	50	Wood poles	2	39.0		
42				66	50	Wood poles	1	51.5		
43				66	50	Wood poles	1	82.5		
44	136 lines reported by this company are here summarized by groups, all those lines having the same physical characteristics being combined into one group.			66	50	Wood poles	1	92.7		
45				66	50	Wood poles	1	359.5		
46				66	50	Tower and pole	1	58.0		
47				66	50	Tower and pole	2	53.4		
48				66	50	Tower and pole	1	155.0		
49				66	50	Steel towers	1	5.0		
50				66	50	Steel towers	1	10.0		
51				220	50	Steel towers	2	11.0		
52				220	50	Steel towers	1	58.5		
53				220	50	Steel towers	1	237.0		
54				220	50	Steel towers	1	442.0		
55				66	50	Steel towers	2	181.1		
	Los Angeles Gas & Electric Corp.									
56	Seal Beach—Los Angeles	1925	200,000	110	60	Steel towers	2	23.6	6,70	
	Bureau of Power & Light									
57	Receiving Station "A"—Receiving Station "B"	Under construction	200,000	132	50	Steel towers	2	11.7	18,25	
58	Receiving Station "B"—Receiving Station "C"	Under construction	200,000	132	50	Steel towers	2	10.68	13,00	
59	San Francisquito Power Plant No. 1—Receiving Station "A"	1917	125,000	110	50	Steel towers	2	44.5	6,13	
60	San Fernando Power Plant—Sylmar Switch Station	1922	7,000	110	50	Steel towers	1	.8	6,30	
61	Power Plant No. 2—Tower No. 44	1920	55,000	110	50	Steel towers	2	1.1	6,13	
	Pacific Gas & Electric Co.									
62	Vaco Dixon—Claremont	1922	40,000(2)	110	60	Steel towers	2	47.9	4,85	
63	Claremont—Newark	1923	29,300(2)	110	60	Steel towers	2	36.7	5,00	
64	Vaca—Dixon—Contra Costa	1927	80,000	110	60	Steel towers	1	28.5	8,11	
65	Wise Junction—Vaca Dixon	1914	30,000	110	60	Steel towers	1	68.6	4,60	
66	Vaca Dixon—Cordelia	1914	30,000	110	60	Steel towers	1	18.4	4,60	
67	Cottonwood—Vaca—Dixon	1921	158,000(2)	220	60	Steel towers	2	141.6	8,11	
68	Pit River No. 1—Cottonwood (Line No. 1)	1922	158,000	220	60	Wood poles	1	60.4		
69	Pit River No. 1—Cottonwood (Line No. 2)	1922	158,000	220	60	Steel towers	1	60.4	4,85	
70	Pit No. 3—Pit No. 3 Junction	1925	100,000	220	60	Steel towers	1	8.6	4,85	
71	Newark—Morgan Hill	1928	30,000	110	60	Steel towers	2	31.0	5,00	
72	Oakland—Newark	1924	30,000	110	60	Steel towers	2	4.87	4,60	
73	Newark—San Jose	1927	30,000(2)	100	60	Steel towers	2	14.45	4,85	
74	Drum—Wise—Newark	1916 and 1919	30,000(2)	110	60	Steel towers	2	161.45	4,60	
75	San Francisco—Newark	1925	40,000	110	60	Steel towers	2	35.0	4,85	
76	Stanislaus—San Francisco	1909	25,000(2)	104	60	Steel towers	2	137.58	4,57	
77	Spring Gap—Stanislaus	1921	15,000	104	60	Wood poles		12.3		
78	Manteca—Salinas	1926	25,000	104	60	Wood poles	1	100.0		
79	Melones—Manteca	1927	25,000	104	60	Steel towers	1	42.7	4,57	
80	Shasta—Delta	1925	40,000	110	60	Wood poles	1	41.3		

	17	Two-arm	Texas Creosote	Aluminum	211,600	168	22	54	500	5	
	9	H-frame and 2-arm	Texas Creosote	Aluminum	211,600	120	22	60	600	10	
	9	H-frame	Texas Creosote	Aluminum	133,100	120	22	60	600	11	
	9	H-frame	Texas Creosote	Aluminum	211,600	120	22	60	600	11	
	14	Single pole 2-arm	Texas Creosote	Aluminum	133,100	108	22	54	375	4	
	14	Flat arm	Texas Creosote	Aluminum	133,100	54	22	16	375	4	
	9	H-frame	Texas Creosote	Aluminum	133,100	120	22	60	600	11	
	9	H-frame	Texas Creosote	Aluminum	211,600	120	22	60	600	11	
	12	Flat-arm	Texas Creosote	Aluminum	66,300	54	22	16	440	12	
	14	2-arm	Texas Creosote	Aluminum	133,100	108	22	54	375	4	
	9	H-frame	Texas Creosote	Aluminum	211,600	168	22	84	600	9	
	9	H-frame	Texas Creosote	Aluminum	133,100	120	22	60	600	11	
	12	H-frame and flat arm	Texas Creosote	Aluminum	133,100	54	22	16	440	5	
	9	H-frame		A.C.S.R.	No. 4/0	168	35	40	600	10	
	9—18	H-frame single pole		A.C.S.R.	No. 2/0 (.1045 sq. in.)	84	37	36	300	3	
	18	H-frame single pole		A.C.S.R.	No. 1/0 (.0829 sq. in.)	84	37 con. of sp.	3	300—600	3	
	9	H-frame		A.C.S.R.	No. 2/0 (.1045 sq. in.)	168	30	60	600	12	
	10	H-frame		A.C.S.R.	No. 4/0 (.1662 sq. in.)	168	30	60	600	12	
	9	H-frame		A.C.S.R.	No. 4/0 (.1662 sq. in.)	168 flat	35 con. of sp.	60	600	10	
	9	H-frame		A.C.S.R.	No. 4/0 (.1662 sq. in.)	168	35 con. of sp.	60	600	10	
	18	Single pole		A.C.S.R.	No. 1/0 (.0829 sq. in.)	96 hor., 84 vert.	27	36	300	3	
	18			A.C.S.R.	No. 1/0 (.0829 sq. in.)	96 hor., 84 vert.	37	36	300	3	
	18	Single pole		A.C.S.R.	No. 1/0 (.0829 sq. in.)				300		
	8½	H-frame 29 foot cross-arms		A.C.S.R.	No. 4/0	168	22	84	600	11	
	8½	H-frame 29 foot cross-arms		A.C.S.R.	No. 2/0	168	22	84	600	12	
	26	45 foot creosoted poles		A.C.S.R.	No. 2/0	108 hor., 84 vert.	25	49	200	2	
	14	50 foot creosoted pine poles		A.C.S.R.	No. 2/0	108 hor., 84 vert.	25	49	375	4	
	8½	H-frame 14 foot centers 29 foot cross-arms		A.C.S.R.	No. 4/0	168	22	84	600	10—11	
	17½	Single creosoted pine poles		A.C.S.R.	No. 4/0		22	49		2½	
	8½	H-frame 29 foot cross-arms		A.C.S.R.	No. 4/0	168	22	84	600	10	
	17½	50 foot creosoted pine poles		A.C.S.R.	No. 2/0	108 hor., 84 vert.	22	49	300	3	
	8	H-frame 22 foot cross-arms 12 foot spacing		Aluminum	No. 4/0	132	22	61	550	12	
	8½	H-frame 11 foot pole center 22 foot cross-arm		A.C.S.R.	No. 4/0	120	22	60	600	12	
	17½	Single creosoted pine pole		A.C.S.R.	No. 4/0	108 hor., 84 vert.	22	49	300	2½	
	17½	Single creosoted pine pole		Aluminum	No. 2/0	9 foot hor., 7 foot vert.	22	49	300	4	
	18	Single pole		Aluminum	No. 2/0	84 hor., 84 vert.	22	37	300	4	
	17½	Single creosoted pine pole		A.C.S.R.	No. 4/0	108 hor., 84 vert.	22	49	300	2½	
	8½	H-frame 29 foot cross-arm		A.C.S.R.	No. 4/0	168	22	84	600	11	
	8½	H-frame 29 foot cross-arm		A.C.S.R.	No. 4/0	168	22	84	600	11	
	8½	H-frame 29 foot cross-arms		A.C.S.R.	No. 4/0	168	22	84	600	11	
	8½	H-frame 29 foot cross-arms		A.C.S.R.	No. 4/0	168	22	84	600	11	
	8½	H-frame 29 foot crross-arms		A.C.S.R.	No. 4/0	168	22	84	600	10	
	17½	Single creosoted pine poles		A.C.S.R.	No. 1/0	108 hor., 84 vert.	22	49	300	2½	
	8½	H-frame 29 foot cross-arms		A.C.S.R.	No. 4/0	168	22	84	600	11	
	17½	Single wood pole, 3 cross-arms		A.C.S.R.	No. 4/0	84	22	49	300	3	
	17½	Single creosoted pole		A.C.S.R.	No. 2/0	108 hor., 84 vert.	22	49	300	2½	
	8	H-frame 29 foot cross-arms		A.C.S.R.	No. 4/0	168	22	84	660	13	
	17½	Single creosoted pine pole		A.C.S.R.	No. 1/0	84 hor., 84 vert.	22	37	300	3	
	19	Single creosoted pole		Aluminum	No. 2/0	108 hor., 84 vert.	22	49	275	3	
	7	H-frame 29 feet cross-arms		A.C.S.R.	No. 1/0	168	22	84	750	17	
	17½	Single creosoted pole		A.C.S.R.	No. 1/0	84 hor., 84 vert.	60	37	300	3	
	17	Single pole		Cu.	No. 2	72	35	(Pin insul.)	300	3½	
	10	H-frame		No. 1 strand Cu.	83,694	106	28	48	500	18	
	23	Single pole		No. 1 aluminum	83,694	84	25	32	225	5	
600; B 15,000	6.5	A- suspension, B-strain	American Bridge	A.C.S.R.	336,000	144	22	39	1000		
00; 12,200	6.13	A and B	American Bridge	A.C.S.R.	336,000	156	22	38	600		
A-3,000	13.6		Milliken	Chiefly Cu.[1]	12. mi. No. 0; 14 mi. No. 1	156 and 124	22	38	660	18	
00; B-12,200	7.5	A-suspension, B-strain	R-C.; Milliken	Chiefly Cu.[2]	120 mi. No. 1/0; 29 mi. No. 1	156 and 124	22	38	600	18	
	6.34			A.C.S.R.	No. 3/0	156	22		828		
2,800	7	Steel bolted	U. S. Wind Eng.	H.d. Cu. 7 strand	133,080	180	20	39	800	17.6	
2,800	7	Steel bolted	Muskogee Iron	Cu. 7 strand	133,080	153	20	39	800	17.6	
2,800	7	Steel bolted	Pacific Coast	H.d. Cu. 7 strand	133,080	153	20	39	800	17.6	
2,800	7	Steel bolted	Pacific Coast	H.d. Cu. 7 strand	133,080	153	20	39	800	17.6	
2,200	10	Windmill	Aermotor	Cu.	83,694	120	19	30	500	9.75	
	9	H-frame	Cedar poles	Cu. strand	300,000	180	30	60	725		
	8.91	H-frame		A.C.S.R.	477,000	180	37	69	600	14	
	11	H-structure		Cu. strand	83,690	120	27	36	475	10	
	18	Pole 38 mile; H-structure 9 mile		Cu. strand	83,690	84	30	36	300	3	
	18			M.h.d. Cu.	No. 4 and No. 2	72	30		300	5	
	10	H-frame		Cu.	No. 2	96	25		600		
	18			Cu.	No. 1/0	72	30		300	3	
	18			Cu.	No. 4	72	25		300	8	
	18 and 10			M.h.d. Cu.	No. 2	72 and 96	33 and 25		300	4	
	35			Aluminum	No. 1/0	72	28		150	2.5	
	10	H-frame		M.h.d. Cu.	No. 2/0	126	31		500	14	
		H-frame		Cu.	250,000	176	26		600	11.5	
	35			M.h.d. Cu.	No. 2/0	72	30		150		
	9			M.h.d. Cu.	250,000	126	30		600	16	
	20			Cu. strand	66,373	72	25	56	300	2.4	
	20			Cu. strand	133,079	72	25	56	300	2.2	
	13							18			
	11										
	16							18			
	13			Cu.	83,700	82	30	18	450	6.1	
	12	H-frame		A.C.S.R.	No. 4/0	144	30	48	440	5.3	
		H-frame		Cu. strand	No. 1/0	144	30	48			
incl. X-arms	112	Steel poles	Milliken	Cu. strand	No. 1/0	120 vert.; 162 horiz.	30	48	440	11.5	
0; R.R. 6,700; 11,400	8	Double circuit, steel	Milliken	A.C.S.R.	No. 4/0	120 (198 hor.)	29	48	660	10.5	
	11	Single wood pole		H.d. strand Cu.	No. 2/0	117 hor.; 90 vert.	30	42	(1)	(1)	
	20	Single wood pole		Aluminum	No. 3/0	72	24		264	6.1	
		Single wood pole		Cu. strand	No. 1/0, No. 2/0 h.d.	(a) 117h.; 90v.; (b) 86	30	42	(1)	(1)	
	20	Single wood pole		Cu. strand	No. 1/0	72	24		264	1.7	
	11	Single wood pole		A.C.S.R.	No. 2/0	117 hor.; 96 vert.	32.5	42	450	7.4	
	10	H-frame		A.C.S.R.	No. 4/0	116	32	48	528	9.6	
	10	H-frame		A.C.S.R.	No. 4/0	116	32	48	528	9.6	
incl. X-arms	12	Steel pole	Milliken	Cu. strand	No. 1/0	126 hor.; 120 vert.	30	48	440	11.5	
		H-frame		A.C.S.R.	No. 4/0	144	30	48			
				Cu.	No. 4	120	30		220		
				Aluminum	No. 2/0	120	30		220		
				Cu.	No. 4/0	120	30		220		
				Aluminum	No. 4/0	120	30		220		
				Cu.	No. 2/0	120	30		220		
				Cu.	No. 1/0	120	30		220		
				Cu.	No. 2/0	120	30		220		
				Cu.	No. 3/0	72	30		220		
				Cu.	No. 2	120	30		220		
				Cu.	No. 3/0	120	30		220		
				Aluminum	No. 4/0	120	30		220		
				Cu.	No. 4/0	120	30		220		
				Cu.	No. 2/0	See general descript ion in follow ing columns					
				Cu.	No. 4/0						
				Cu.	No. 4/0						
				Cu.	No. 2	72	30		700		
				Cu.	No. 2/0	144	30		700		
				Cu.	650,000	264	30		Old, 600; new, 1,200		
				Aluminum	667,000	264	30				
				Aluminum	1,033,000	264	30				
				Aluminum steel	605,000	264	30				
				Cu.	No. 4/0	72	30		700		
6,700	6.5	Suspension anchor and special	Pacific Coast	Cu.	300,000	120	30	41 7/16 (max. defl.)	825	23	
18,250	7	Valley	Pacific Coast	Cu.	500,000	288 hor.; 180 vert. (angle, 216 vert.)	35	44; (angle 56) (max. wind)	750	18	
13,000	7	Valley	Pacific Coast	Cu.	500,000		35		750	18	
6,130	8	Valley	Blaw-Knox	Cu.	300,000 and 250,000	120	30	56 (max. wind)	725	18	
6,300	8	Snow	Pacific Coast	Cu.	211,600	180	26	42	742	16	
6,130	8	Valley	Blaw-Knox	Cu.	211,600	120	30	36 (max. wind).	650	14	
4,850	8	A-H	Pacific Coast	Cu.	250,000	120	35	78	800	22	
5,000	8	Twin circuit	Pacific Coast	Cu.	No. 4/0; No. 3/0	120	30	30	800	22	
8,110	8	M	Pacific Coast	Cu.	500,000	180	32	108	800	22	
4,600	8	A	Milliken	Al. 58.5 mi.; Cu. 10.1 mi.	266,800; Cu. No. 3/0	120	35	78	800	22	
4,600	8	A	Milliken	Cu.	No. 3/0	120	35	78	800	22	
8,110	8	M	Pacific Coast	Cu.	500,000	180	32	108	800	22	
	10	2-pole structures		A.C.S.R. 27.9 mi.; Cu. 32.5	518,000; 500,000	180	42	90	500	14	
4,850	10	S.-A.	Pacific Coast	A.C.S.R. 27.9 mi.; Cu. 32.5	518,000; 500,000	180	42	90	500	14	
4,850	8	S.-A.	Pacific Coast	A.C.S.R.	518,000	180	42	90	500	14	
5,000	8	A.-H.	Pacific Coast	Cu.	No. 3/0	120	30	30	800	22	
4,600	8	A.	Pacific Coast	Cu.	No. 3/0	120	35	78	800	22	
4,850	8	A.-H.	Pacific Coast	Cu.	No. 3/0	120	35	78	800	22	
4,600	8	A.	Pacific Coast, Milliken	Cu.	No. 3/0	120	35	78	800	22	
4,850	8	A.-H.	Pacific Coast	Cu.	250,000	120	35	78	800	22	
4,570	8	50 foot double circuit	Aermotor	Cu., hemp core	No. 2/0	108	30	60	800	16.5	
	9	2-pole structure		A.C.S.R.	133,220	120	30	60	600	10.5	
	15	Single, 2 and 3 pole structure		Cu.	No. 2/0	120	30	60	350	6	
4,570	8	A-50 double circuit	Pacific Coast	Cu.	No. 2/0	108	30	60	800	16.5	
	9	2-pole structures		Cu.	250,000	120	35	60	600	15	

No. of Footnote	No. of Line	
(3)	22	(K
(1)	5	(P
(2)	6	(P
(3)	8	(S
(1)	25, 27	(S; He
(2)-62, 63, 67, 73, 74, 76		(S

22	54	300	3	1,400	Horizontal	66,000	5	10" suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio
22	66	660	10	1,400	Horizontal	66,000	5	10" suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio
22	60	600	11	700	Horizontal	66,000	5	10" suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio
22	60	600	11	700	Horizontal	66,000	5	10" suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio
22	54	375	4	900	Horizontal	66,000	5	10" suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio
22	16	375	4	900	Horizontal	66,000	1	Pin 66 Kv.	Graybar	6	Suspension disc 10"	Ohio
22	66	660	11	700	Horizontal	66,000	5	10" suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio
22	60	600	11	700	Horizontal	66,000	5	10" suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio
22	16	440	12	900	Horizontal	66,000	1	Pin	Graybar Elec.	6	Suspension disc 10"	Ohio
22	54	375	4	900	Horizontal	66,000	5	10" suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio
22	54	600	9	1,400	Horizontal	66,000	5	10" suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio
22	60	600	11	700	Horizontal	66,000	5	10" suspension disc	Ohio Brass	6	Suspension disc 10"	Ohio
22	16	440	5	900	Horizontal	66,000	1	Pin	Graybar	6	Suspension disc 10"	Ohio
35	48	600	10	1,350	Horizontal	66,000	5	Tho. No. 11,069; No. A-257	Thomas, J-D.	6	Suspension	Thomas
37	36	300	3	800	Vertical	66,000	5	Suspension cap and ball	Ohio Brass	6	Suspension cap and ball	Ohio
37 cen. of sp.	3	300—600	3	650	Vertical	66,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension cap and ball	Ohio
30	60	600	12	700	Horizontal	66,000	5	Suspension cap and ball	Ohio Brass	6	Suspension cap and ball	Ohio
30	60	600	12	1,350	.....	66,000	5	Suspension cap and ball	Ohio Brass	6	Suspension cap and ball	Ohio
35 cen. of sp.	60	600	10	1,350	Horizontal	76,000	6	Suspension No. 25,622	Ohio Brass	2x10	Suspension No. 25,622	Ohio
35 cen. of sp.	60	600	10	1,350	Horizontal	76,000	6	Suspension No. 25,622	Ohio Brass	10	Suspension No. 25,522	Ohio
27	36	300	3	650	△	66,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension cap and ball	Ohio
37	36	300	3	650	.....	66,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension cap and ball	Ohio
.....	.....	300	.....	650	.....	66,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension cap and ball	Ohio
22	54	600	11	850	Horizontal	72,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio
22	54	600	12	600—700	Horizontal	72,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio
25	49	200	2	.....	.....	66,000	1	Pin No. 12,552	Ohio Brass	6	Suspension No. 25,622	Ohio
25	49	375	4	.....	.....	72,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio
22	54	600	10—11	900	.....	72,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio
22	49	.....	2½	900	△	72,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio
22	54	600	10	900	.....	72,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio
22	49	300	3	600	.....	72,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio
22	61	550	12	800	.....	66,000	5	Suspension No. 35,622	.....	6	Suspension	.....
22	60	600	12	600	Horizontal	72,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio
22	49	300	2½	.....	△	66,000	1	Pin No. 12,552	Ohio Brass	6	Suspension No. 25,620	Ohio
22	49	300	4	.....	.....	.....	.....	.....	.....	.....	.....	.....
22	37	300	4	.....	.....	60,000	1	Pin	.....	6	Suspension and pin	.....
22	49	300	2½	.....	△	72,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio
22	54	600	11	850	Horizontal	72,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio
22	54	600	11	850	Horizontal	72,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio
22	54	600	11	850	Horizontal	72,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio
22	54	600	11	850	.....	72,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio
22	54	600	10	900	Horizontal	72,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio
22	49	300	2	.....	△	66,000	1	Pin No. 12,552	Ohio Brass	6	Suspension No. 25,622	Ohio
22	54	600	11	900	Horizontal	132,000	9	Suspension No. 26,240	Ohio Brass	12	Suspension No. 25,620	Ohio
22	49	300	3	.....	Vertical	72,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio
22	49	300	2½	900	△	72,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio
22	54	660	13	800	Horizontal	72,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio
22	37	300	3	.....	△	66,000	1	Pin No. 12,552	Ohio Brass	6	Suspension No. 25,622	Ohio
22	49	275	3	.....	△	66,000	1	Pin No. 12,552	Ohio Brass	6	Suspension No. 25,622	Ohio
22	54	750	17	.....	.....	72,000	5	Suspension No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio
60	37	300	3	.....	△	66,000	1	Pin No. 12,552	Ohio Brass	6	Suspension No. 25,622	Ohio
35	(Pin insul.)	300	3½	.....	△	66,000	1	Pin No. 12,552	Ohio Brass	5	Suspension No. 25,622	Ohio
28	48	500	18	.....	Horizontal	70,000	4	Suspension	Lapp	5	Suspension	La
25	32	225	5	.....	Byllesby Wishbone	66,000	1	Pin	Thomas & O. B.	1	Pin	Tho
22	59	1000	.....	.....	.....	120,000	7	Cap and pin No. 25,622	Ohio Brass	7	Cap and pin No. 26,240	Ohio
22	38	600	.....	.....	Horizontal	120,000	7	Cap and pin No. 25,622	Ohio Brass	7	Cap and pin No. 26,240	Ohio
22	38	660	18	1,250	Horizontal	110,000	5	Hewlett	Thomas	6	Hewlett	Tho
22	38	600	18	1,250	Horizonta.	110,000	5 and 6	Hewlett and cap and pin	Thomas and O. B.	6 and 8	Hewlett and cap and pin	Thoma
22	.....	828	.....	.....	Horizontal	120,000	7 and 8	Cap and pin No. 25,622	Ohio Brass	..	Cap and pin No. 25,622	Ohio
20	39	800	17.6	1,843	△	520,000 dry flash	8	Suspension	Locke & West	8	Suspension	Locke;
20	39	800	17.6	1,843	Horizontal	520,000 dry flash	8	Suspension	W'hse; Locke	8	Suspension	W'hse;
20	39	800	17.6	1,843	Horizontal	520,000 dry flash	8	Suspension No. 25,622	Ohio Brass	8	Suspension No. 25,622	Ohio
20	39	800	17.6	1,843	Horizontal	520,000 dry flash	8	Suspension	Locke; W'hse	8	Suspension	Locke;
19	30	500	9.75	770	.....	80,000	4	Suspension	Thomas	4	Suspension	Tho
30	40	725	.....	6,000	Horizontal	110,000	7	Suspension	Locke	8	Suspension	Lo
37	69	600	14	4,000	Horizontal	165,000	10	Cap and pin	W'hse No. 601	14	Cap and pin	W'hse
27	36	475	10	730	Horizontal	75,000	5	Suspension standard	Ohio Brass	6	Suspension b. s. standard	Ohio
30	36	300	5	800	.....	75,000	5	Suspension standard	Ohio Brass	6	Suspension b. s. standard	Ohio
30	.....	300	5	.....	△	60,000	1	Pin	Ohio Brass	5	10" disc	Lo
25	.....	600	.....	.....	Horizontal	66,000	4	10" disc	Locke	5	10" disc	Lo
30	.....	300	3	.....	△	60,000	1	Pin	Ohio Brass	4	10" disc	Lo
25	.....	300	8	.....	△	60,000	1	Pin	Locke	5	10" disc	Lo
33 and 25	.....	300	4	.....	△	60,000	1	Pin	O. B.; Locke	5	10" disc	Lo
28	.....	150	2.5	.....	△	60,000	1	Pin	Locke	5	10" disc	Lo
31	.....	500	14	900	Horizontal	66,000	4	10" disc	Ohio Brass	5	10" disc	Ohio
26	.....	600	11.5	3,100	Horizontal	66,000	4	10" disc	J.-D.; W'hse	10 (132 kv.)	10" disc	J.-D.;
30	.....	150	.....	.....	△	60,000	1	Pin	Ohio Brass	5	10" disc	Lo
30	.....	600	16	2,150	Horizontal	120,000	7	10" disc	Ohio Brass	8	10½" disc	Ohio
25	56	300	2.4	1,470	Vertical	66,000	1	Pin	O. B. No. 12,552	5	Suspension	Lapp N
25	56	300	2.2	2,785	Vertical	66,000	1	Pin	O. B.; No. 12,552	5	Suspension	Ohio
.....	18	.....	.....	.....	Vertical	66,000	5; 6 on coast	Suspension	Locke	6; 7 on coast	Suspension	Lo
.....	.....	.....	.....	.....	Vertical	58,400	6	Suspension	Locke	7	Suspension	Lo
.....	18	.....	.....	.....	Vertical	66,000	5; 6 on coast	Suspension	Locke	6; 7 on coast	Suspension	Lo
30	18	450	6.1	1,400	Vertical	66,000	5	Suspension	Locke	6	Suspension	Lo
30	48	440	5.3	1,350	Horizontal	110,000	6	Suspension	Jeffery-Dewitt	7	Suspension	Jeffery-
30	48	.....	.....	.....	Horizontal	110,000	7	Suspension	Locke	8	Suspension	Lo
30	48	440	11.5	690	△	110,000	7	Suspension	O. B.; Locke	8	Suspension	O. B.;
29	48	660	10.5	1,500	Vertical w. offset	100,000	6 and 7	Suspension	J.-D.; Locke	7 and 8	Suspension	J.-D.;
30	42	(1)	(1)	2,610 max.	△	88,000	5	Suspension	Jeffery-Dewitt	6	Suspension	Jeffery-
24	.....	264	6.1	226	Equilat. △	60,000	1	Pin	Locke	4 and 5	Suspension	Lo
30	42	(1)	(1)	2,610	(a) Rt. △; (b) eq. △	88,000	1 and 5	Pin; suspension	Locke	6	Suspension	Lo
24	.....	264	1.7	1,670	Equilat. △	60,000	1	Pin	Locke	5 and 6	Suspension	Lo
32.5	42	480	7.4	2,650 max.	△	88,000	5	Suspension	Locke	6	Suspension	Lo
32	48	528	9.6	1,050	Horizontal	110,000	7	Suspension	Jeffery-Dewitt	8	Suspension	Jeffery-
32	48	528	9.6	1,050	Horizontal	110,000	6	Suspension	Jeffery-Dewitt	7	Suspension	Jeffery-
30	48	440	11.5	690	△	110,000	6	Suspension	Jeffery-Dewitt	7	Suspension	Jeffery-
30	48	.....	.....	.....	Horizontal	110,000	6	Suspension	Jeffery-Dewitt	7	Suspension	Jeffery-
30	.....	220	.....	2,500 max.	Horizontal							
30	.....	220	.....	2,500	Horizontal							
30	.....	220	.....	2,500	Horizontal							
30	.....	220	.....	2,500	Horizontal							
30	.....	220	.....	2,500	Horizontal							
30	.....	220	.....	2,500	Horizontal							
30	.....	220	.....	2,500	Horizontal							
30	.....	220	.....	2,500	Vertical							
30	.....	220	.....	2,500	Horizontal							
30	.....	220	.....	2,500	Horizontal							
30	.....	220	.....	2,500	Horizontal							
30	.....	220	.....	2,500	Horizontal							
ript ion in following columns					Horizontal Vertical Horizontal							
30	.....	700	.....	3,500	Horizontal							
30	.....	700	.....	2,500	.....							
30	.....	.....	.....	.....	Vertical							
30	.....	Old, 600; new, 1,200	.....	Old, 6,500; new, 12,000	Horizontal							
30	.....	.....	.....	.....	Horizontal							
30	.....	700	.....	3,500	Vertical							
30	41⅞e(max. defl.)	825	23	4,500	Vertical	132,000	8	Suspension No. 601	Westinghouse	10	Suspension No. 631	Westin
35	44; (angle 56)	750	18	6,150	Vertical	132,000	9	Suspension	Ohio Brass	2x11 std.	Suspension	Ohio
35	(max. wind)	750	18	6,150	Vertical	132,000	9	Suspension	Ohio Brass	1x8 heavy duty	Suspension	Ohio
30	56 (max. wind)	725	18	4,200	Vertical	110,000	7	Suspension	Ohio Brass	2x8 dead-end	Suspension	Ohio
26	42	742	16	2,900	Horizontal	110,000	7	Suspension	Ohio Brass	2x8 dead-end	Suspension	Ohio
30	36 (max. wind).	650	14	2,900	Vertical	110,000	7	Suspension	Ohio Brass	2x8 dead-end	Suspension	Ohio
35	78	800	22	2,750	Vertical	110,000	8	Suspension	Locke	8	Suspension or strain	Lo
30	30	800	22	2,400	Vertical	110,000	9	Suspension	Ohio Brass	10	Strain	Ohio
32	108	800	22	5,600	Vertical	220,000	13 (11-10 & 2-13")	Suspension	Westinghouse	10-10, 2-13"	Dead-end	Ohio
35	78	800	22	1,900	Vertical	110,000	7	Suspension	Ohio Brass	7 or 8	Suspension	Ohio
35	78	800	22	1,900	Vertical	110,000	7	Suspension	Ohio Brass	7 or 8	Suspension	Ohio
32	108	800	22	5,600	Vertical	220,000	13 (11-10 & 2-13")	Suspension	O. B.; Locke	10-10 & 2-13"	Dead-end	Ohio
42	90	500	14	3,400	Horizonta'	220,000	13	Suspension	Ohio Brass	12	Dead-end	Ohio
42	90	500	14	3,400	Horizonta	220,000	13	Suspension	Ohio Brass	12	Dead-end	Ohio
42	90	500	14	3,400	Horizonta.	220,000	13	Suspension	Ohio Brass	12	Dead-end	Ohio
30	30	800	22	1,900	Vertical	110,000	9	Strain	J.-D.; W'hse	10	Strain	J.-D.;
35	78	800	22	1,900	Vertical	110,000	9	Suspension	Ohio Brass	10	Strain	Ohio
35	78	800	22	1,900	Vertical	110,000	8	Suspension	Ohio Brass	10	Suspension or strain	Ohio
35	78	800	22	1,900	Vertical	[illegible]	[illegible]	[illegible]	Ohio Brass	7, 9, 10	Dead-end	Ohio
35	78	800	22	1,900	Vertical	110,000	8	Suspension	Ohio Brass	10	Strain	Ohio
30	60	800	16.5	2,000	Vertical	104,000	6	Suspension	Various	6 or 7	Suspension or strain	Var
30	60	600	10.5	2,750	Horizonta	104,000	6	Suspension	Ohio Brass	6	Suspension or strain	Ohio
30	60	350	6	1,500	△	104,000	7	Suspension	Westinghouse	8	Suspension and dead-end	Westin
30	60	800	16.5	2,000	Vertical	104,000	7	Suspension	Thomas	7	Suspension and dead-end	Tho
35	60	600	15	2,460	Horizonta	110,000	7	Suspension	Ohio Brass	8	Strain	Ohio

General description: All 220-kv. lines are on steel towers. There are two general types—single circuit horizontal which composes mos
double circuit with vertical conductors. The normal space of conductors is 22 feet between phases. Normal span of the old lines is 600 ft.
lbs. Normal span on new lines is 1,200 ft. with maximum tension of 12,000 lbs. Minimum ground clearance is 30 ft. Standard 10 in. discs
house and Lapp are used. In certain locations high strength insulators are used and near the beach fog type insulators are used. The numb
string is from 13 to 15. No lightning arresters are used on these lines. Overhead ground conductor is installed on all lines. Most of th
½" or 9/16" Siemans-Martin. Shield rings are used on insulator strings. Special compression joints are used on all lines. Carrier curre
the long lines. Independent telephone lines parallel the transmission lines from end to end but are built at considerable distance from
66-kv. lines are built on both steel and wood structures. Steel tower line construction is both single circuit horizontal and doubl
being 700 feet. Vertical spacing conductor is 6 feet. Horizontal spacing 12 feet. On wood pole lines the normal spacing is 220 ft., verti
feet. Standard 10 inch discs of Locke, Ohio Brass, and Westinghouse are used. Four to six discs per string being used, depending on loc
Minimum ground clearance is 30 feet. McIntyre sleeves are used on all joints. Arcing horns are installed on the conductor end of the stri
are used. All lines have lightning arresters at both ends. Maximum tension for steel construction is 3,500 lbs., for wood pole line con
system is installed on practically all lines. This is on the supporting structure itself and is used for dispatching and patrolling.

No. of Footnote	No. of Line	
		WEST NORTH CENTRAL
(1)	22	(Kansas City Power & Light Co.) No. 1/7 used through river bottoms and industrial district.
		MOUNTAIN
(1)	5	(Public Service Co. of Colorado) Also 411 ft. ⅜" stranded steel; 3584 ft. copper-clad.
(2)	6	(Public Service Co. of Colorado) Also 2/2 mi. A.C.S.R. No. 3/0.
(3)	8	(Salt River Valley Water Users' Ass'n.) is Miami, Roosevelt, Horse Mesa, Mormon Flat Jc. and Goldfield.
		PACIFIC
(1)	25, 27	(Southern Sierras Power Co.) Light loading: span 480 ft., sag 5.8 ft., no ice, 8 lb. horizontal wind pressure, 70° F. Heavy loading: span 406 ft., sag 8.0 ft., ½ inch ice, 6 lb. horizontal wind pressure, 0° F.
(2)	62, 63, 67, 73, 74, 76	(Southern Sierras Power Co.) Rating per circuit.

Ohio Brass	Yes	4	Locke grading shields					McIntyre joint	Oxide film	G. E.			
Ohio Brass	Yes	4	Locke grading shields					McIntyre joint	Oxide film	G. E.			
Ohio Brass	No	

pension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	No									McIntyr
pension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	Yes	4	Locke grading shields							McIntyr
pension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	Yes	4	Locke grading shields							McIntyr
pension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	Yes	4	Locke grading shields							McIntyr
pension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	No									McIntyr
pension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	No									McIntyr
pension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	No									McIntyr
66 Kv.	Graybar	6	Suspension disc 10"	Ohio Brass	No									McIntyr
pension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	No									McIntyr
pension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	No									McIntyr
Pin	Graybar Elec.	6	Suspension disc 10"	Ohio Brass	No									McIntyr
pension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	No									McIntyr
pension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	No									McIntyr
pension disc	Ohio Brass	6	Suspension disc 10"	Ohio Brass	No									McIntyr
Pin	Graybar	6	Suspension disc 10"	Ohio Brass	No									McIntyr
1,969; No. A-257	Thomas, J-D.	6	Suspension	Thomas; J.-D.	No		Ohio Brass							
n cap and ball	Ohio Brass	6	Suspension cap and ball	Ohio Brass	No		Clamp	None			Ohio Brass No. 70,231, 9¼"			Sleev
on No. 25,622	Ohio Brass	6	Suspension cap and ball	Ohio Brass	No		Clamp	None			Suspension Ohio Brass No. 70,756, 9¼'			Sleev
n cap and ball	Ohio Brass	6	Suspension cap and ball	Ohio Brass	No		Clamp	None			Suspension Ohio Brass No. 70,756, 9¼"			Sleev
n cap and ball	Ohio Brass	6	Suspension cap and ball	Ohio Brass	No		Clamp	None			Ohio Brass No. 70,756, 9¼"			Sleev
on No. 25,622	Ohio Brass	2x10	Suspension No. 25,622	Ohio Brass	1 less	5	Lower, main line only, clamp	30			Ohio Brass No. 70,756, 9¼"			Sleev
on No. 25,622	Ohio Brass	10	Suspension No. 25,522	Ohio Brass	St. line only	5	Clamp	Yes		30x15	only near station] Ohio Brass			Sleev
on No. 25,622	Ohio Brass	6	Suspension cap and ball	Ohio Brass	Yes		Lower only, clamp	None			Ohio Brass No. 70,731, 9¼"			
on No. 25,622	Ohio Brass	6	Suspension cap and ball	Ohio Brass	No		Clamp	None			Suspension Ohio Brass No. 70,756, 9¼"			Sleev
on No. 25,622	Ohio Brass	6	Suspension cap and ball	Ohio Brass	No		Clamp	None			Suspension Ohio Brass No. 70,756, 9¼"			Sleev
											Suspension Ohio Brass No. 70,756, 9¼"			Sleev
on No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	No		O. B. suspension clamps							
on No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	No		None	None			Ohio Brass suspension, No. 4/0			Twist
No. 12,552	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	No		None	None			Ohio Brass suspension, No. 2/0			Twist
on No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	No		None	None			Ohio Brass suspension, No. 2/0			Twist
on No. 25,622	Ohio Brass	6	Suspension No. 25,630	Ohio Brass	No		None	None			Ohio Brass suspension, No. 2/0			Twist
on No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio Brass	No		None	None			Ohio Brass suspension, No. 4/0			Twist
on No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio Brass	No		None	None			Ohio Brass suspension, No. 4/0			Twist
on No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	No		None	None			Ohio Brass suspension, No. 4/0			Twist
on No. 35,622		6	Suspension		No		None	None			Ohio Brass suspension, No. 2/0			Twist
on No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio Brass	No		None	None			Ohio Brass suspension			Twist
No. 12,552	Ohio Brass	6	Suspension No. 25,620	Ohio Brass	No		None	None			Ohio Brass suspension, No. 2/0			Twist
											Tie wire			Twist
Pin		6	Suspension and pin				None	None			Tie wire			
on No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio Brass	No		O. B. suspension clamps	None			Ohio Brass suspension, No. 4/0			Twist
on No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio Brass	No		O. B. suspension clamps				Ohio Brass suspension, No. 4/0			Twist
on No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	No		O. B. suspension clamps				Ohio Brass suspension, No. 4/0			Twist
on No. 25,622	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	No		O. B. suspension clamps				Ohio Brass No. 4/0 A.C.S.R.			Twist
on No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio Brass	No		O. B. suspension clamps	None			Ohio Brass suspension, No. 4/0			Twist
on No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio Brass	No			None			Ohio Brass suspension, No. 4/0			Twist
No. 12,552	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	No		No	None			Tie wire			Twist
on No. 26,240	Ohio Brass	12	Suspension No. 25,620	Ohio Brass	No		O. B. suspension clamps	None			Ohio Brass suspension, No. 4/0			Twist
on No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio Brass	No		O. B. suspension clamps	None			Ohio Brass suspension, Nos. 4/0, 1/0			Twist
on No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio Brass	No		O. B. suspension clamps	None			Ohio Brass suspension clamps, No. 4/0			Twist
on No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio Brass	No		O. B. suspension clamps	None			Ohio Brass suspension clamps, No. 4/0			Twist
No. 12,552	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	No		None	None			Tie wire			Twist
No. 12,552	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	No		None	None			Tie wire			Twist
on No. 25,622	Ohio Brass	6	Suspension No. 25,620	Ohio Brass	No		O. B. suspension clamp	None			Ohio Brass suspension, No. 1/0			Twist
No. 12,552	Ohio Brass	6	Suspension No. 25,622	Ohio Brass	No		None	None			Tie wire			Twist
No. 12,552	Ohio Brass	5	Suspension No. 25,622	Ohio Brass	No		None	None			On angles and dead-ends only			Sleev
uspension	Lapp	5	Suspension	Lapp	No						Suspension, No. 1			Sleev
Pin	Thomas & O. B.	1	Pin	Thomas	No		None	None			None			Aluminum
d pin No. 25,622	Ohio Brass	7	Cap and pin No. 26,240	Ohio Brass	No		Ohio Brass				Ohio Brass			Sleeve, pressed Al
d pin No. 25,622	Ohio Brass	7	Cap and pin No. 26,240	Ohio Brass	No		Ohio Brass				Ohio Brass			Sleeve, pressed Al
Hewlett	Thomas	6	Hewlett	Thomas	No		Made locally							
and cap and pin	Thomas and O. B.	6 and 8	Hewlett and cap and pin	Thomas; O. B.	No		Made locally							Sleev
d pin No. 25,622	Ohio Brass	..	Cap and pin No. 25,622	Ohio Brass	No		Near sta. O. B.				Groove, No. 4/0			Sleev
uspension	Locke & West	8	Suspension	Locke; W'hse	No		None	None			Locke			McIntyre
uspension	W'hse; Locke	8	Suspension	W'hse; Locke	No		None	None			Locke No. 3,045, 9"			McIntyre
sion No. 25,622	Ohio Brass	8	Suspension No. 25,622	Ohio Brass	No		Ohio Brass	None			Ohio Brass No. 70,756			McIntyre
uspension	Locke; W'hse	8	Suspension	Locke; W'hse	No		None	None			Locke			McIntyre
Suspension	Thomas	4	Suspension	Thomas	No		None	None			Locke, No. 3,304			Cu. twist
uspension	Locke	8	Suspension	Locke	No		None	None			Ohio Brass No. 72,582			
ap and pin	W'hse No. 601	14	Cap and pin	W'hse No. 631	No		None	Dead-end	30	30	Susp. Thomas No. 10,049; strain Al. Co. No. 711			2-piece compr
nsion standard	Ohio Brass	6	Suspension b. s. standard	Ohio Brass	No		None	None			Ohio Brass No. 11,538			Sleeves, Mem
nsion standard	Ohio Brass	6	Suspension b. s. standard	Ohio Brass	No		None	None			Ohio Brass No. 11,538			Sleeves, Mem
Pin	Ohio Brass	5	10" disc	Locke	No		None	None						
10" disc	Locke	5	10" disc	Locke	No		None	None						3-wi
Pin	Ohio Brass	4	10" disc	Locke	No									3-wi
Pin	Locke	5	10" disc	Locke	No		None	None						
Pin	O. B.; Locke	5	10" disc	Locke	No		None	None						3-wi
Pin	Locke	5	10" disc	Locke	No		None	None						3-wi
10" disc	Ohio Brass	5	10" disc	Ohio Brass	No		None	None						Sleev
10" disc	J.-D.; W'hse	10 (132 kv.)	10" disc	J.-D.; West.			Flat strap	None						Sleev
Pin	Ohio Brass	5	10" disc	Locke	No		None	None						Sleev
10" disc	Ohio Brass	8	10½" disc	Ohio Brass	No		None	None						3-wi
Pin	O. B. No. 12,552	5	Suspension	Lapp No. 2,300	No		Ohio Brass	None			Ohio Brass suspension			Sleev
Pin	O. B.; No. 12,552	5	Suspension	Ohio Brass	No		Ohio Brass	None			Ohio Brass suspension			Sleev
Suspension	Locke	6; 7 on coast	Suspension	Locke	No		None	None						
Suspension	Locke	7	Suspension	Locke	No		None	None						
Suspension	Locke	6; 7 on coast	Suspension	Locke	No		None	None			Ohio Brass No. 10,755; Locke No. 4,333			Seamless Cu
Suspension	Locke	6	Suspension	Locke	No		None	None						
Suspension	Jeffery-Dewitt	7	Suspension	Jeffery-Dewitt			None	None						
Suspension	Locke	8	Suspension	Locke			None	None			Victor No. 592; dead-end No. 3,267			Aluminum steel c
Suspension	O. B.; Locke	8	Suspension	O. B.; Locke			None	None						
Suspension	J.-D.; Locke	7 and 8	Suspension	J.-D.; Locke			None	None						Seamless Cu
Suspension	Jeffery-Dewitt	6	Suspension	Jeffery-Dewitt				None			Locke No. 2,585; dead-end No. 2,614 (modified)			Aluminum steel c
Pin	Locke	4 and 5	Suspension	Locke			None	None			Thomas No. 10,086; dead-end Locke No. 3,032			Seamless Cu
n; suspension	Locke	6	Suspension	Locke			Locke	None						McIntyre
Pin	Locke	5 and 6	Suspension	Locke			None	None			L. Nos. 4,333, 5,147; dead-end 3,032; O. B. 10,755			Seamless Cu
Suspension	Locke	6	Suspension	Locke			Yes							Seamless Cu
											Locke No. 8,466; dead-end Al. Co. No. 702			Seamless Alumi
Suspension	Jeffery-Dewitt	8	Suspension	Jeffery-Dewitt			Yes							
Suspension	Jeffery-Dewitt	7	Suspension	Jeffery-Dewitt			None	None			Locke No. 8,477; strain No. 2,614			Aluminum
Suspension	Jeffery-Dewitt	7	Suspension	Jeffery-Dewitt			None	None			Locke No. 5,366; strain No. 3,052			Aluminum steel c
Suspension	Jeffery-Dewitt	7	Suspension	Jeffery-Dewitt			None	None						Seamless Cu
											Locke No. 5,366; dead-end No. 3,052			Aluminum steel c

nes are on steel towers. There are two general types—single circuit horizontal which composes most of the transmission lines, and
The normal space of conductors is 22 feet between phases. Normal span of the old lines is 600 ft. with maximum tension of 6,500
ft. with maximum tension of 12,000 lbs. Minimum ground clearance is 30 ft. Standard 10 in. discs of Locke, Ohio Brass, Westing-
cations high strength insulators are used and near the beach fog type insulators are used. The number of insulators installed to the
arresters are used on these lines. Overhead ground conductor is installed on all lines. Most of the lines have two ground wires,
ings are used on insulator strings. Special compression joints are used on all lines. Carrier current telephone is used over one of
e lines parallel the transmission lines from end to end but are built at considerable distance from the transmission right of way.
l and wood structures. Steel tower line construction is both single circuit horizontal and double circuit vertical, normal spans
uctor is 6 feet. Horizontal spacing 12 feet. On wood pole lines the normal spacing is 220 ft., vertical spacing 6 feet; horizontal 10
Ohio Brass, and Westinghouse are used. Four to six discs per string being used, depending on location with respect to the ocean.
McIntyre sleeves are used on all joints. Arcing horns are installed on the conductor end of the string. No overhead ground wire
resters at both ends. Maximum tension for steel construction is 3,500 lbs., for wood pole line construction 2,500 lbs. Telephone
nes. This is on the supporting structure itself and is used for dispatching and patrolling.

														McIntyre

Intyre joint	Oxide film	G. E.					No. 6 copperweld	No. 5 Copperweld	75
Intyre joint	Oxide film	G. E.					No. 6 copperweld	No. 5 high tensil Cu.-weld	76
Intyre joint	Oxide film	G. E.					No. 6 copperweld	No. 8 copper	77
Intyre joint	Oxide film	G. E.					No. 6 copperweld	No. 8 copper	78
Intyre joint	Oxide film	G. E.					No. 6 copperweld	No. 5 copperweld	79
Intyre joint	Oxide film	G. E.					No. 6 copperweld	No. 5 copperweld	80
Intyre joint	Oxide film	G. E.					No. 6 copperweld	No. 8 copper	81
Intyre joint	Oxide film	G. E.					No. 6 copperweld	No. 8 copper	82
Intyre joint	Oxide film	G. E.					No. 6 copperweld	No. 6 A.C.S.R.	83
Intyre joint	Various						No. 6 copperweld	None	84
Intyre joint	Oxide film	G. E.					No. 6 copperweld	No. 5 high tension copperweld	85
Intyre joint	Various						No. 6 copperweld	No. 5 high tension copperweld	86
	Various						No. 6 copperweld	No. 5 high tension copperweld	87
Sleeves	None	None	None				No. 6 galvanized iron wire	None	88
Sleeves	Oxide film and auto-valve	W'hse; G.E.					No. 6 galvanized iron wire	Magneto 2-wire	89
Sleeves	None		None				No. 6 galvanized iron wire	None	90
Sleeves	Oxide film	G. E.	None				No. 6 galvanized iron wire	Magneto 2-wire	91
Sleeves	Oxide film	G. E.	None				No. 6 galvanized iron wire	Magneto 2-wire	92
Sleeves	Oxide film	G. E.	None				No. 6 galvanized iron wire	Telephone	93
								None	94
Sleeves	Oxide film	G. E.	None				No. 6 galvanized iron	Magneto 2-wire	95
Sleeves	None						No. 6 galvanized iron	Magneto 2-wire	96
Sleeves	None		None				No. 6 galvanized iron	None	97
wist sleeves	Oxide film	G. E.					No. 6 iron wire	Independent telephone	98
wist sleeves	Oxide film	G. E.	None				No. 6 galvanized iron wire	Independent telephone	99
wist sleeves	Oxide film	G. E.	None				No. 6 copperweld	Telephone circuit on same poles	100
wist sleeves	Oxide film	G. E.	None				No. 6 copperweld	Telephone on same poles	101
wist sleeves	Oxide film	G. E.	None				No. 6 iron wire	Telephone on same poles	102
wist sleeves	Oxide film	G. E.	None				No. 6 iron wire	Telephone on same poles	103
wist sleeves	Oxide film	G. E.	None				No. 6 galvanized iron wire	Telephone on independent poles	104
wist sleeves	Oxide film	G. E.	None				No. 6 iron wire	Telephone on same poles	105
wist sleeves	Yes		None				No. 6 iron wire	Telephone on same poles	106
wist sleeves	Oxide film	G. E.	None				Copperweld	Telephone on same poles	107
wist sleeves	Oxide film	G. E.	None				No. 6 iron wire	Telephone on same poles	108
									109
wist sleeves	Yes		None				No. 6 iron wire		110
wist sleeves	Oxide film	G. E.	None				No. 6 iron wire	Telephone on separate poles	111
wist sleeves	Oxide film	G. E.					No. 6 iron wire	Independent telephone	112
wist sleeves	Oxide film	G. E.					No. 6 iron wire	Independent telephone	113
wist sleeves	Oxide film	G. E.					No. 6 iron wire		114
wist sleeves	Oxide film	G. E.	None				No. 6 iron wire	Telephone on separate poles	115
wist sleeves	Oxide film	G. E.	None				No. 6 iron wire	Independent telephone circuit on separate poles	116
wist sleeves	Oxide film	G. E.	None				No. 6 iron wire	Telephone circuit on same poles	117
wist sleeves	None		Special Aluminum	236,000 c.m.	1		No. 6 iron wire	Independent telephone	118
wist sleeves	Oxide film; auto-valve	G.E.; W'hse	None				No. 6 iron wire	Telephone circuit on separate poles	119
wist sleeves	Oxide film; auto-valve	G.E.; W'hse	None				No. 6 iron wire	Telephone on same poles	120
wist sleeves	Oxide film, auto-valve	G.E.; W'hse	None				No. 6 iron wire	Independent telephone circuit	121
wist sleeves	Oxide film	G. E.	None				No. 6 iron wire	Telephone on same poles	122
wist sleeves	Oxide film, auto-valve	G.E.; W'hse	None	No. 6			No. 6 iron wire	Independent telephone	123
wist sleeves	Oxide film	G. E.	None				No. 6 iron wire	Independent telephone	124
wist sleeves	Oxide film	G. E.	None				No. 6 iron wire	Telephone on same poles	125
Sleeves	Oxide film	G. E.	None				None	Public telephone	126
Sleeves	Auto-valve	W'hse	None					None	1
ninum sleeves	Aluminum	G. E.	Galvanized stranded	¼	1		No. 4 iron wire	2-wire bridge type telephone	2
sed Aluminum splice	Oxide film; auto-valve	G.E.; W'hse	Siemens-Martin steel	5/16	1			Leased Bell telephone	3
sed Aluminum splice	Oxide film	G. E.						Telegraph & Telephone	4
	Oxide film; auto-valve	G.E.; W'hse	Siemens-Martin steel	3/8	1 (5.5 mi.)			Telegraph & Telephone	5
Sleeves	Horn gaps		Siemens-Martin steel	5/16	1 (2.2 mi.)			Telegram & Telephone	6
Sleeves	None		None					Telephone	7
ntyre sleeves	Oxide film	G. E.	None				Anchor bolt masonry pier	Telephone	8
ntyre sleeves	Oxide film	G. E.	None				Concrete footing ground only	Telephone	9
ntyre sleeves	1; oxide film	G. E.	S.-M. extra galv.	5/16	2		1—No. 2/0 Cu. cable pad 7'0" deep	Telephone	10
ntyre sleeves	1; auto-valve	W'hse	None				Concrete footings	Telephone	11
twist sleeves	Sub., oxide film	G. E.	Stranded steel	5/16	1		No special tower footings	Telephone on separate pole line	12
	Oxide film	G. E.	None				Driven pipe	Carrier current	1
compression joint	None		None				None	Metallic circuit	2
Memco, seamless	Oxide film	G. E.	None					None	3
Memco, seamless	Oxide film	G. E.	None				No. 6 iron	No. 8 copperweld	4
3-wire	None		None				None	Wire telephone	5
3-wire	None		None				None	Wire telephone	6
	None		None				None	Wire telephone	7
3-wire	None		None				None	None	8
3-wire	None		None					None	9
Sleeves	Electrolytic	G. E.	None				None	Wire telephone	10
Sleeves			None				None	Wire telephone	11
Sleeves	Oxide film	G. E.	None				None	Wire telephone	12
3-wire			None				None	Wire telephone	13
	None		None				None	Wire telephone	14
Sleeves	Oxide film; auto-valve	G.E.; W'hse	None				No. 6 iron with individual driven point	Metallic telephone on power lines	15
Sleeves	Oxide film; auto-valve	G.E.; W'hse	None					Metallic telephone on power lines	16
less Cu. sleeves	None		None				Pins bonded with No. 6 or No. 4 Cu.		17
							Pins bonded with No. 6 or No. 4 Cu.		18
							Pins bonded with No. 6 or No. 4 Cu.		19
							Pins bonded with No. 6 or No. 4 Cu.	None	20
steel cable connector	Oxide film	G. E.						2-wire on separate poles	21
less Cu. sleeves								2-wire on separate poles	22
steel cable connector	Oxide film	G. E.	Siemens-Martin steel	¾	1			2-wire on separate poles	23
less Cu. sleeves	Aluminum cell	G. E.						2-wire on separate poles	24
ntyre sleeves	Aluminum cell; oxide film	G. E.						2-wire on separate poles	25
less Cu. sleeves	Oxide film	G. E.						2-wire on separate poles	26
less Cu. sleeves	Horn gap	Bowie sw.						2-wire, on power poles	27
Aluminum sleeves								Public telephone	28
									29
ninum sleeves	Auto-valve	W'hse						2-wire on separate poles	30
steel cable connector	Aluminum cell	G. E.						2-wire on separate poles	31
less Cu. sleeves	Oxide film	G. E.						2-wire on separate poles	32
steel cable connector	None								33
			None						34
			None						35
			None						36
			None						37
			None						38
			None						39
			None						40
ntyre sleeves	See general description in preceding columns		None				See general description in preceding columns	See general description in preceding columns	41
			None						42
			None						43
			None						44
			None						45
			None						46
			None						47
			None						48
			None						49
			None						50
compression joint	None		Siemens-Martin steel						51
compression joint	None		Siemens-Martin steel						52
compression joint	None		Siemens-Martin steel	½ or 5/16					53
compression joint	None		Siemens-Martin steel	½ or 5/16					54
Sleeves			None	½ or 5/16					55
tube Cu. sleeves	At terminal, auto-valve	W'hse	Galvanized steel	7/16	1		Copper plate	Metallic circuit	56
compression joint	None		Steel	½	1		Buried copper pipe	Telephone on separate poles	57
compression joint	None		Cu.	No. 4/0	1		Buried copper pipe	Telephone on separate poles	58
ntyre sleeves	Electrolytic, auto-valve	W'hse	Steel	¾	1		Buried copper pipe	Carrier current	59
ntyre sleeves	Electrolytic	G. E.	Steel	¾	1		Buried copper pipe	Telephone on separate poles	60
ntyre sleeves	Oxide film	G. E.	Steel	¾	1		Buried copper pipe	Carrier current	61
wist sleeves	None		None				None	Carrier current	62
wist sleeves	None		None				One tower leg ground to galvanized plate	2-wire telephone part way	63
screw connection	None		None				None	None	64
wist sleeves	None		None				None	None	65
wist sleeves			None				None	None	66
screw connection	None		None				One leg to ground plate	Carrier current	67
um, compression	None		None				None	Carrier current	68
Cu. factory			None				Ground plate on one footing	Carrier current	69
w connection	None		None				Ground plate on one footing	None	70
wist sleeves	None		None				One tower leg ground to galvanized plate	None	71
wist sleeves	None		None				None	2-wire circuit telephone	72
wist sleeves	None		None				None	2-wire circuit telephone	73
wist sleeves	None		None				None	None	74
wist sleeves	None		None				None	None	75
wist sleeves	Electrolytic	G. E.	None				Earth footings	None	76
wist sleeves	Electrolytic	G. E.	None				None	None	77
wist sleeves	None		None				None	None	78
wist sleeves	None		None				Earth footings	None	79
	None		None				None	None	80